Popular Science

FOUNDED MONTHLY 1872

Wonders of the Honey Bee at Close Range (see page 42) 25 CENTS 00 New Ideas for the Home and Shop

Here—the new Radiolas!

New Triumphs of Radio Invention— New Performance Records

"There's a Radiola for every juste"

\$35 to 5425

	\$35 to 5425			
† Model	Price	Approximate Range	Type of Antenna	Degree of Selectivity
With two WD-11 Radiotrons' and head telephones,	\$35	Up to 1500 miles with headphones Local stations on Loudspeaker.	Outdoor or in- door antenna.	Improved selectivity, Minimum radiation,
Radiols Balanced Amplifier To be used with Radiola III. With two WD 11 Radiotrons.*	\$30	Gives Loud- speaker operation with Radiola III up to 1500 miles under favorable conditions.	Outdoor or in- door antenna.	
with four WD-11 Rad- iotrons, head tele- phones and Radiola Loudspeaker. Same without Loud- speaker.	\$100 \$65	Loudspeaker op- eration up to 1500 miles under fa- vorable condi- tions.	Outdoor or in- door antenna-	Improved selectivity. Minimum radiation,
Radiola Regenofics with four WD-11 Rad- lotrons,* and Radiola Loudspeaker. Same without Radio- trons or Loudspeaker.	\$206 \$150	Loudspeaker op- eration up to 2000 miles under fa- vorable condi- tions.	Outdoor or in-	Batraordi- nary selec- tivity. Nen radiating,
Radicia X with four WD-11 Radictrons,* Loud- speaker built-in,*	\$245	Loudspeaker op- eration up to 2000 miles under fa- vorable condi- tions.	Outdoor or in- door antenna.	Extraordi- nary selec- tivity. Nor radiating.
Radiola Super-Heteradyna with siz UV-199 Redio- trons* and Radiola Loudspeaker. Same without Radio- trons or Loudspeaker.	\$286 \$220	Loudspeaker op- eration up to 2000 miles with inter- nal loop. With external loop up to 3000 miles un- der favorable conditions.	No antenna. (Concrated small loop built into set.)	Super-selec- tivity, Non radiating.
Radiola Super-VIII with six UV-199 Radiotrons," Loud- speaker built-in.	\$425	Loudspeaker op- eration up to 3000 miles under fa- vorable condi- tions.	No antenna. (Concealed large loop built into set.)	Super-selec- tivity, Nor endlating

1 All Radiolas sold without batteries.

RCA

* Only dry batteries used.

Send this coupon for an illustrated booklet that tells the story completely, with described description of every set

RADIO CORP. OF AMERICA Dept. 135. [Address office nearest you] Please send me your new free Radio

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State

Radio Corporation of America

Sales Officer: 233 Broadway, New York 10 So. La Satte St., Chicago, Ill. 433 California St., San Francisco, Cal.

Radiola

The MARATHON RUNNER OF TODAY

AN army of 100,000 Persians, the mighty Darius at their head. The fair city of

Athens, with only 10,000 men to protect it, doomed to destruction; its citizens facing death or slavery. Assistance must be had. The utmost speed was essential. The athlete, Mede, volunteered.

From Athens to Sparta, 140 miles in 36 hours. People marvelled at the unheard of speed with which the message was carried. That was in 490 B. C.

How rapidly we have progressed—from runner to radio. Distance is no longer a handicap when a message must be sent or received. On the contrary, there is added pleasure and wonder at the sound of a human voice speaking in Honolulu truly reproduced in your New York or Florida home, through the medium of a Crosley Radio Receiver.

For bringing in distant stations clearly, distinctly and with great volume, Crosley Radio Receivers are unexcelled. Local interference may be quickly tuned out, and the opera, music, speech or any one of a hundred other entertainments or happenings from some far distant point may be enjoyed in your own living room.

Large production allows us to offer Crosley Instruments and parts at very low prices—the greatest values in radio, we believe. Read the descriptions of the Crosley Sets illustrated here. Decide which kind you would like to have. Then go to your dealer and purchase it.

The hours of pleasure that the Crosley will bring you and your family cannot be estimated.

For Sale by Good Dealers Everywhere Write for Free Catalog

THE CROSLEY RADIO CORPORATION

POWEL CROSLEY, JR., President

The Precision Equipment Company and Crosley Manufacturing Company
517 ALFRED STREET CINCINNATI, OHIO





A Wide Selection of Crosley Super-Radio Receivers

CROSLEY MODEL X-J-A long distance receiver, the most popular in America, we believe. Contains four tubes, consisting of one stage of radio frequency amplification, detector and two stages of audio frequency amplification.

CROSLEY TYPE 3-B-Just as efficient as it is beautiful. A three tube Armstrong Regenerative Receiver, consisting of detector and two stages of audio frequency amplification.

CROSLEY MODEL VI—A two tube medium range receiver of exceptional merit. Consists of one stage of radio frequency amplification and detector.

CROSLEY MODEL 51—The wonderful new instrument that has astounded the radio world. It is an Armstrong Regenerative two tube set containing detector and one stage of audio frequency amplification and yet sells at the remarkably low price of \$18.50.

CROSLEY TYPE V—The single tube Armstrong regenerative receiver, used by Leonard Weeks of Minot, N.D., in keeping in constant communication with the McMillan Expedition at the North Pole.

CROSLEY TYPE 3-C—A beautiful Consolette Model, adding greatly to the interior decoration of any home. It is an Armstrong Regenerative set, containing the same units as the Crosley Type 3-B.

The Crodey Regenerative Receivers described above are manufactured under Armstrong U.S. Patent No. 1,113,149

The Crud Gentleme	ley Radio C	orporati	on, \$17 Al	TODAY— fred St., Cise charge your ruments and	complete
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Popular Science Monthly

Most Wonderfully Illustrated Magazine in the World

MAY, 1924; Vol. 104, No. 5 25 cents a Copy; \$2.50 a Year



Published in New York City at 225 West Thirty-ninth Street

YOUNG friend of mine stopped in front of a hardware store the other day. "Some of the doors at home stick badly and that's a fine excuse to get myself a good plane," he said. course, I could get a carpenter to come around and fix the doors for a couple of dollars, but I'm going to get the plane.

My young friend knows the thrill of tools. He knows the creative joy that comes in doing things. and doing them well. For him a fine tool is a delight -a means of recreation from his worksday world. And so he constantly seeks for an excuse to add to the contents of his toolchest.

FOR most men, whether they are mechanics or not, tools have a real and vital fascination. And is it any wonder? Every time you pick up a saw, a hammer, or a chisel, you have comething that symbolizes most vividly the upward climb of the ages. It is a volume of thrilling history and romance. It is a monument to the persistent mechanical and scientific efforts of your ances-

tors, historic and prehistoric, through countless centurice.

TAKE the saw, for instance. The handsaw in your household toolkit, the milling cutters of the machinist, the 108-inch inserted tooth circular saws that operate at a rim speed of 130 miles an hourthese are miracles of inventive genius. Their lineage is linked with the mechanic arts of all past eras.

The Greeks had saws. Hippocrates, four centuries

trepanning skulls. There were iron saws in Biblical times—and sometimes they did shocking service in sawing asunder prisoners of war. The Egyptians cast saws in bronze and are credited with having used inserted teeth of gems for cutting hard rock. Back in the Age of Bronze there were notched saws of bronze and, yet more remote, in the mists of the Stone Age, were saws patiently chipped from flint.

THE story of modern tools and their facilitation of the work of the world is told each month in POPULAR SCIENCE MONTHLY. Look through the pages

of this issue and read the month's history of tools and tool users. Picture the tools and machinery neceseary for an undertaking as vast as the project to harness the tides of the Bay of Fundy, as described on page 291 You can only realize what an amazing mechanism your watch is (see "Does Your Watch Know You?" page 38) when you stop to think that in making it there were necessary 3733 distinct operations with tools!

N THESE columns I have stressed frequently the need for enthusiasm. Without enthusiasm little can be accomplished in life. But nowadays men often expend much enthusiasm without accomplishment. That is because enthusiasm is not

always employed intelligently.

An enthusiasm for tools is one that a man can put into harness and make work for him. He learns how to put himself into his efforts and to employ facilities that increase his own powers. And the bookcase, the settee, and the other simple furniture in the home of my young friend offer a convincing argument for the value of his hobby.

MEN who know tools best seem to love them best. IVI The late Joe V. Romig once wrote: "My workbefore Christ, is said to have invented a drum saw for shop comes second only to my family in my affections.

> It is a dream shop - a boy's dream made possible through a man's work and development."

How the true mechanic makes the most of his tools is the message carried this month - and every month - in our Home Workshop and Better Shop Methods Departments,---THE EDITOR

Laboratory Tests to Aid You in the Selection of Radio, Tools and Other Equipment

TO MEET the need of the ever-I increasing number of people who are interested in things mechanical and electrical, POPULARSCIENCE MONTHLY has established an organization for testing radio sets and apparatus, tools of all kinds and equipment for the automobile.

The testing will be conducted by THE Prof. Collins P. Bliss, of New York University.

Full details of this important new service will be announced in the June issue.

POPULAR SCIENCE INSTITUTE OF STANDARDS under the direction of

POPULAR SCIENCE MONTHLY

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Blanne Yourself If This Message Doesn't Bring You A Big Salary Increase

Take any ten men in blind-alley jobs at low pay. Analyze each case. You'll find that everyone of them is to blame. Everyone of them has had a golden opportunity. They either have failed to recognize it, or lacked the courage to follow it up. Now comes your chance. If this page doesn't bring you a big increase in salary—quick—you have no one to blame but yourself.

By J. E. Greenslade

Let's be specific. What do you want in life? You want more money than you're getting. You want your own home, a car, membership in a good club, you want to wear good clothes, educate your children and put away enough money to make you independent. If you are like other men, you want to be your own boss in a position that grows every day in interesting fascination. You want to travel, see the world, and meet the wide-awake people who are doing things.

All right. I'll tell you a quick, easy way to accomplish all this. If you don't take it you are the only one who will have to face the accusing finger of the man you might have been. If you do take it, you'll thank me the rest of your life for putting this information in your hands. For now it is possible for you to quickly enjoy bigger earnings, and have all the joys in life that your bigger self demands. If this was a guess I couldn't print it. I know it to be a certainty. It is proved by the cases of thousands of other men who have done exactly the same thing. Listen.

What It Brought These Men

Charles Berry, a farm hand of Winterset, Iowa, was offered this chance. He took it and jumped from \$18 a week to a position paying him \$1,000 the very first month. J. P. Overstreet, Denison, Texas, was on the Capitol Police Force at less than \$1,000 a year. He wasn't content with a bare living and he jumped to an income of \$1,800 in the tooks. F. Wynn, of Portland, Oregon, an

ex service man, wanted the joy of a real success. He earned \$544 in one week. George W. Kearns, working on a ranch for \$60 a month, took the quick road I offer you and in two weeks he carned \$524. Warren Hartle of Chicago, was a railway mail clerk for ten years—in as deep a rut at as low an income as any man could stand. But he wanted success, he longed for the good things of life that he saw other men having. He took my advice and carned over \$7,000 the first year.

The Secret is Yours

But, of course, you want to know how it's done. I'll tell you. Although none of these men had ever sold a thing in their lives—though many believed that a salesman must be "born" a salesman—we took them, without experience or training of any kind, and in a short period of time made Master Salesmen of them. Then our Employment Department helped them to select the right position and they were off with a boom to the success they had dreamed of.

The National Salesmen's Training Association can do exactly this for you. If this big organization of Master Salesmen and Sales Managers had raised the salaries of only a few men, then you might call it luck. But we've been doing it for fifteen years, day in and day out. Today we're so accustomed to the amazing increases in salary our members receive that we take them as a matter of course.

There is only one thing I ask of you in return for this offer. Don't let the idea of a big salary, the thought of traveling all around the country and meeting worth-while people, make you think that the job is beyond you. Keep an open, unprejudiced mind on this subject—at least until you have seen the remarkable book that I want to send you without charge.

Read This Free Book

This book, "Modern Salesmanship," explains why thousands have quickly succeeded in the selling field—how it is easy to make big money once you are in possession of the Secrets of Selling—how you can quickly get these fundamental secrets, apply them and achieve a quick and permanent success. This is the book I will send you, absolutely free of obligation and expense, Read it through and then decide for yourself.

But remember this one thing: This is your opportunity. If you don't realize a big salary increase from this message, you have no one to blame but yourself. Send me the coupon before you turn this page and I'll send "Modern

and I'll send "Modern Salesmanship" immediately,

National Salesmen's Training Ass'n

Dept. 15-E Chicago

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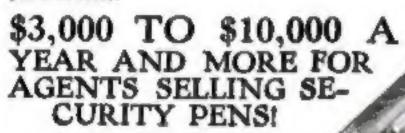
FOR SERVICE

HIS wonderful combination of a perfect, amonth-writing, non-leakable fountain pen with a unique and practical check protector enables the writer to write and protect bin checks any time—any place. Just think! \$53,000,000 was lost in one year through alterations of checks and other negotiable papers.

The Security Check Protecting Fountain Pen is designed to give protection of EVERY KIND, EVERYWHERE, against EVERY port of check-manipulating crookedness. Its kuife-edged steel rotating, cutting wheel scores the paper and files the scoring with an iterndicable acid-proof ink, which can not be removed. This protection is given to the amount, payer's name, check number, date and memoranda. It affords equal protection to names, amounts, signature and important clauses

on deeds, wills, contracts, etc.

The Fountain Pen itself is the result of 17 years' experiment. It flows so easily, writes so smoothly and is so durable that on these merits alone it should cause most fountain pen users to discard their present pen in its favor.



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If you are anxious to get into a clean business, with the exclusive selling rights in your respective territory, if you are ambitious and hard-working, full of pep and stick-to-it-iveness, then write today.

We have a very interesting proposition to offer

PRICES

No. 300 \$3.50 No. 400 \$4.00 No. 600 \$5.00 *No. 800 \$7.60

Long and Short Models
"No 100 Security made
in a beautiful red and
black (mettled) finish
with an extra gold
band, has an exceptionally large in h expectry.

WONDERFUL SIDE-LINE

You can make real money every day, not only in your spare hours but even when calling on your regular trade. Every business man in your territory is a potential prospect for a SECURITY. Every sale coments a lasting friendship with your buyer. The SECURITY needs only to be demonstrated to eliminate sales resistance. A few pean sold in a city or town will develop an ever increasing business in your territory. Five distinctive features mean quick sales. The check protector alone will close the sale in three minutes.

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Experienced extension who have the ability of organizing a direct to consumer sales force and can finance themselves to the extent of from \$300 to \$1,000 can easily care \$5,000 to \$10,000 a year. Write us a letter giving a brief history of yourself, past superionce, references and turnitury wanted.

UNLIMITED SALES POSSIBILITIES

When you stop to consider that five hundred thousand pens were sold in the United States in 1900 and that the cales last year amounted to more than eighteen million pans, you can readily visualize the splendid and unlimited sales possibilities of the SECURITY compared with the ordinary fountain pens.

Remember that there is only one SECURITY on the market, fully protected by six patents, and that we furnish a five year written guarantee with each pen.

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Order a Security today and we will give You a complete demonstrating outfit free of charge. After you have received the pengiven it a fair trial, sold yourself thoroughly on fit merits and convinced yourself that it is the best fountain pen on the market and that the check protecter alone is worth more than the price of the pen itself, then you and show it to your friends and nequaintances, some business men, including your banker, ad you will be surprised how easily you can get their orders.

Giant

87.00

Requaintances, some business men, including your banker,
and you will be surprised how easily you can get their orders.

If on the other hand, you do not find the Security all that we claim it to be
and are not thoroughly satisfied, return the pen to us at our expense and the full
purchase price will be refunded to you, without any "its" or "ands." This is a go,
We mean business.

ALBERT G. BURNS, Director of Sales.

SECURITY PEN CORPORATION

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No. 100

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SECURITY PEN	CORPORATION,	Dept. P. S. 1
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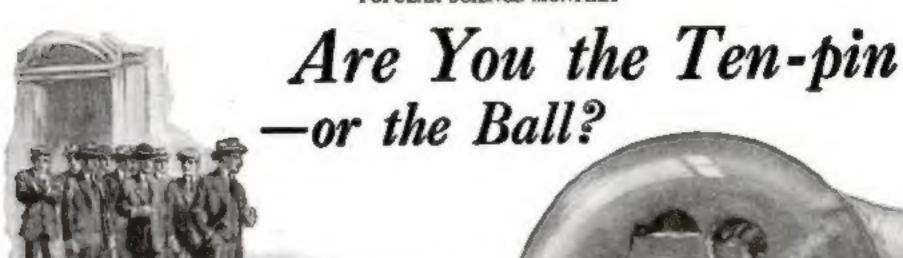
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Enclosed find...... rbeck...... names order, \$..... Send

NAME.....

ADDRESS.

STATE....



WHEN a champlonship contest is impending, the athlete who trains spanmodically, or who refuses to train at all, is regarded by his team-mates with contempt. His self-indulgence is never a subject for joking—it is nothing short of treachery.

The business world views the matter somewhat differently.

If a man neglects to train for a bigger job, why worry? There are plenty of able and ambitious men who will.

Every year, for example, more than 60,000 men enrolled with LaSalle Extension University are throwing themselves heart and soul into the all-engrossing contest for the better positions in business—are earnestly declaring their purpose to win or know the reason why.

In the contest for success they know that they must be either the ten-pin or the ball—and they prefer to be the ball,

The career of A. V. McDuffie, of Fayetteville, North Carolina, well illustrates the opportunities that unfold to the man equipped to take advantage of them.

In 1916 McDuffie was earning only \$15 a week. He was married, and had one little daughter. McDuffie had always had it in mind to become a Certified Public Accountant, but the way seemed impossible. Prompted by his wife, he enrolled with LaSalle Extension University; and evening after evening, according to his story, he stuck to his studies, urged to do so by the question, "Are you content to be just a mere bookkeeper all your life, on starvation wages?"

Today, McDuffie has realized his ambi-

tion. Owner of a halfinterest in a successful firm of Certified Public Accountants, his average profits, even during dull years, are in excess of \$10,000 a year.

When a man, checked at every turn by a stender income and the responsibility of providing for a family, is able—thru home-study training—to outclass his competition so decisively, how certain should be the future of the man who starts to train unhandicapped by circumstances!

Thousands of LaSaile-trained men unconsciously direct attention to this thought; their letters are replete with evidence, of which such statements as the following are typical;

"At the last stockholders' meeting I was made general auditor, at a salary increase of 20 per cent since my envolument. Without Labelle I should not have been considered for this responsible position."—F. H. Kanney.

"Since enrolling I have increased my income from EO to over \$400 a month, and the end is not in sight." - M. C. Kochman.

"LaSaire training has meant a tremendous thing to me in mental development and financial profit,"—W. A. Twelkemuir, "Passed bar examination with second highcet honors in a class of 71."—M. A. Caruso.

"LaSalle training has taken me from the \$2-2 month class to a present earning power of over \$7,000 per annum."—R. A. Warner.

To overcome the obstacles that every man must face who hopen to attain executive responsibility requires excuestness of purpose; and beyond a doubt the unusual success of Labelle-trained men is due, in considerable measure, to the inherent pluck and determination which gave them the urgs to make the start.

The sublifity of their advancement, however, brings forth a different explanation - to be found, as many assert, in the Labelle Problem Method.

Under this plan, distinctive with LaSalle Extension University, a member masters business principles by solving actual business problems—under the direction of some of the ablest men in their respective fields in America. The business power that

moults from each practical and thore preparation is a constant menace to the man who will not train,

During three months' time, for example, as many as 1,793 LaSalle members reported definite promotion over the beads of untrained men. Incidentally, the total salary increases of these men amounted to \$2,268,526, an average increase per man of 39 per cent.

In the face of such plain handwriting on the wall, how pathetic is the man who fails to see the necessity for specialized business training—or who casts saide his present opportunity, to await a day that never comes.

On the other hand, how great the rewards that accrue to the man who escapations his mood—and acts decisively to meet it.

...

During coming months what will you be doing with year spate evening hours? Will you be preparing to hold your own against these thousands of mon who are plusting their natural ability and staming with training—or will you go down like a ten pin, besten by some man, not so good as you, perhaps, who has equipped himself to play the game successfully?

A booklet which has proved of unusual worth to many thousands is available to you; it will give you fall particulars of a definite plan for self-improvement—will show you compelling swideness of what other men in circumstances similar to yours have done to increase their salaries and to step sheed to responsible executive positions. With this booklet Labelle will send you without obligation your copy of "Tee Vents' Promotion in One," a human-interest recital of how an average man won his way to success.

The areas is built - the great game for secores in business is in progress - and whether you will or no you must step to the mark and do your best.

Just such a coupon as appears below this test has given many a man his start toward real schlevoment. Check, sign and mail that coupon NOW - and write it on your heart that you are to the fight to term.

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BIJCH Generators, brand new, 6 voits, maximum report 22 amperes at 2000 r. p. m. Government paid 945.00 each, our grice \$10.00. General Sales Company, 1921 S. Michigan Avenue, Chicago, Hilmon.

ONE 16"130" Pratt and Whitney Planer, 3174. One 11"34" Artisan Laths new, \$125. One 20" drill press, \$45.00. Complete line machinery and supplies. Cincinnati Machinery Supply Co., 217 E. Pearl Street, Cincinnati, Ohio.

MOTORS-O, Z., M R. P. Sil. 00 b. H. P. Sil. 50. I H. P. \$52.50. Generation, 8 volt, 10 amp., \$15.00; 22 roll, 500 watt, \$30.00. Cuber sizes, low prices. Motor Specialton Co., Crafton, Pennsylvania.

SHOP EQUIPMENT

CERCULAR Saw for bench. Write Han 17, Hacketintown, New Jersey.

MANUFACTURING

LPT us make your wood tors, patterns, cattling, or stampings, send specifications for our prices. Alvatab Manufacturing Co., Batavia, New York.

DIFS, Took and General Manufacturing Manufacturing of new townsteins our specialty, Machine Co., 223 S. Clinton St., Chicago, III.

AVIATION

Briy's get a "Ing shot aeroplane that fire several hundred feet, dives, loops the loop, spirals. Fostpant for. Chambles Acroplane Company, 1844 East 18th St., Cleve-land, Ohie.

Another \$25.00 IN PRIZES

for Popular Science Readers

To win one of these cash prizes is easy, and every reader is invited to enter this feacinating competition. Just write a letter of not over seventy words answering this question:-

What advertisement of "Money Making Opportunities" in this issue interests you most and why?

Here are the prizes we will pay for the ten best letters answering the above question: -

First Prize .	ı.			+		\$1	10.00
Second Prize	1	+		+	+	+	5.00
Third Prize							3.00
And 7 Prizes							
of \$1.00 each		4	+	+	+	4	7.00

First read every one of the "Money Making Opportunity" advertisements on pages 6 to 15. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, not more than seventy words, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before May 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the July louse. Address your prize letter to

Contest Editor

POPULAR SCIENCE MONTHLY 225 West 29th Street, New York City

Last Month's Prize Winners

The First Prize of \$10.00 goes to Mr. Gordon Malsed, of St. Paul. Minn., for his letter on the advertisement of W. Stedman Richards. Here is Mr. Malsed's letter:

Contest Editor —

Money Making Opportunities" ofbeyed through Portilian Sciences have been of benefit to one between him the Service offered by W. Stadenas Richard's cume had when I required evide as sensulting absente, offering experienced professional across at a law pear. The clear, sancter and shower argued gave not secure confidence in placing my problem. Result: Prompt solution—member lessers, through source pleasing—member lessers, through source pleasing—member lessers,

Mr. R. Melnoe, of St. John, N. B., wine the Second Prize for the following letter on the advertisement of American Photography.

GORDON F. MALSED.

Dear Street Looking over Moory Making Opportunities" I now "Have you a Camera? I had, but wasn't satisfied with the results I got. Sent for copies of American Photography and their subscribed. The bettend ariseles, and cristerious I envised on priots, mon put means the right path and I have not ensure to pay for the subscriptions and all the new putter I need.

I meed.

R. MELROSE. R. MELROSE.

The Third Prize goes to Mrs. H. L. Hogrefe, of Albaquerque, New Mexico.

The Winners of the other seven prizes are:

Clay Pless, Budrollie, Ala., Laura P. Coons, Riverside, Cal., Gaurge Raymonds, Altoons, Pa., Burke Gragg, Rancaurte, West Va., E. C. Taylor, Boulder, Col., Erroll Moss, Lincoln, Neb. and E. W. Gloow, Ann Harbor, Mich.

Rate 26 Cents a Word. Advertisements in-tended for the July issue should be received by May 5th

RADIO AND SUPPLIES

VOL don't kned tubes to get out of town. If you want new stations up your crystal set, write me today. Mine works 400 to 1,000 miles without tubes or battersest Thomasade have bought my plans and how get resides like entre Changes often cost less than dollar. Scotlandstreamed cuvelops for further information. Loom Larabert, 353A to. Volume 8t., Withita, Karsad.

CHYSTAL Radio Receiving Set. Convented. Only 50c pestpaid. Dealers wanted. Tru-Elg Supply Co., 104 Lake Ave., Rochester, N. Y.

WANTED Representative in every town, Small investment. Large Profits. Write for particulars to East-Des-Asteroff Instrument Co., Rediands, Calif.

LOUD Speaking Crystal Set. Renadcastings heard throughout house. Eastly constructed. Instructions complete 15c. Cataing free. Steinment Wireless Mignor, 2016 Penn Ave., Principally. One to five tubes, including Neutrodyne, Reflex Superdyne, and Two Stage Ampaller, whose runn 1000 hours on one charge of the ampere sour battery mend the or cover of Noull carton for lessaket exactnings complete information in Asian Manufacturing Company, Dept M, 52 Willow St., Springfield, Mass.

M. RADIDELAN Burgerspread, wear our attractive.

MR. RADIOFAN Be recognized wear our attractive Radio Endoese, only one dellar, worth more, B. K. W., 10 Westwood Drive, San Crancisco, Calif.

#UPPER ratio A and B riverit batteries, which bring in long distance reception. Sold for runh or on payment plan. Write for prices and detacts. Radio Settery Inspection. 501-B Industrial Bank Ridg. Flint, Much. Blut HARGE year were out "R" Rattery for \$12, Formula and Instructions 50c pentipuid, Mosarch Raim temporary. Owego, N. Y. Mosarch Raim (empany, Owego, N. Y. Mosarch Raim, 10, pp. 115-00, 32, 36, 1 B. P., 802-50. Generators, 8 volt. 10 step. \$15.00; 32, volt. 500 west, \$30.00. Other stars, low prices. Mosarch Specialization Co., Crafton, Pentonylvania.

DX-CNE-TURE Radio Receives, \$12.55 Cowell, \$219 West \$2, Cleveland, Onle.

FOR THE HOME

CRANDFATHER clock works, \$5.00. Build your own case, matractions free; make good profits adding your triatale. Clock works with chimes for out or new cases, write the fall particulars. Clock Co., Nicctown, Penn. GASOLINE house, lasterus and bestern. Catalog free, Little Wunder hitg. Co., Terre Haute, Indiana.

if OMAII weaving looms only \$9.90, lain money in securing rugs, service, partiered, etc., at large, from rugs and waste material. Weavers are rughed with orders, send for free loom book, it tells all about the wraving loomess and our wooderful \$0.00 and other looms. Union Loom Works, \$82 Factory \$2, Doonville, New York.

WANTED

DETECTIVES - Excellent apportunity. Forciasing work. Experience uncorressory Particulars from With American Detective Firstern, 1968 Broadway, New York. TYPICTS - Flore \$25-\$100 weekly in spare time copy-g authors manuscripts. Write R. J. Carnes, P.-I. Takabus authors manuscripts. Write poises, Georgia, for particulars.

OLD gold, effect and platform for cash. Pean Lab-aratories, 722 Market St., Newark, N. J.

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CART for old gold, allver, platinum, watches, diamonds, magneta points, gold crowse, take treth, and other valuables. Marrianolise returned if offer upually factory. Sunch Producis, Dept. 55, 144 Fifth Ave., New York.

Mall, Old Gold, Silver, Piatinum, Diamonda, Jewelry, Bouds, Thrift, Unused Fustage Stamps, etc. Money wired within and hour for valuables, held ten days, returned if unsatisfactory. Ohio resetting Ca., 315 Hipporesome Blig., Gleveland, Ohio.

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ADVERTISING rates for magazines and weekliss fees. Charles A. Lais. Apartment 241, York, Pennyalters.

24 WORLDS machine list of 70 Sunday and westly companies, 10.00. AdMerer, 4112P, Hartford, 84,

selli, von reni estate, stocks, bistiness, etc. 34-word ad in 100 syndicate magazines. \$2.00: 20 California Sunday papers. \$15: 20 his Sunday papers covering United States. \$20. Lists and other rates free. Sample syndicate magazine. 15 cents. California Advertiding service. \$24 Laughlia building. Los Ameles. California. INCH display 100 magazines, thrier, \$8. Herk, 5406,

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More Money Making Opportunities on pages 8 to 25



15 Minutes a Day and I'll Grow New Hair for You In a Month — Or No Cost!

I have grown new hair for hundreds of others in 30 days. If I can't do the same for you —I don't want to keep a cent of your money. Let me send you—absolutely free—the evidence of what my new method has done for others. Just mail the coupon below.

By ALOIS MERKE

Founder of Famous Merke Institute, Fifth Ase., N. Y.

REALIZE that I'm making an exceptional offer. I realize that probably no one ever dared to make such an offer before. But I mean every word I my. Give me 15 minutes a day for one month. And no matter how thin your bair may now be—my treatment will give you a new growth of hair in 30 days—or the test won't cost you a cent.

Sounds too good to be true—doesn't it? But I have already grown new hair for hundreds of others—many of whom had long ago despaired of regaining their hair. And if I can't do the same for you—just tell me so. There will be no red-tape or bother. Without asking a single question I'll instantly and gladly mail you a check refunding every cent you have paid me. That's my absolute GUARANTEE. I don't want your money unless—after 15 minutes of your time each day for a month—I grow new hair on your head.

Entirely New Method

Up to now many people believed that when hair fell out and ordinary measures failed to grow new hair that the roots were always dead. But from close observations made while treating hundreds of cases of thin, scanty falling bair—I found that in a very great many lostances the hair roots were not stad—but merely dorment. The question is how in the world can hair-tonics and so called "restorers" ever grow hair when they do not even approach the cause of falling hair—dormant hair roots.

You would never think of rubbing "growing fluid" on the leaves of a dying plant and expect the plant to grow. Instead you would get right down to the roots and nourish them. It is exactly the same with the hair.

My treatment is the result of long years of experience ment at Heidelberg, Berlin, Paris, Culto, Ge-

WHAT USERS SAY

Stores of Other Letters Tell the Same Story

Hair Growth After I Wooks

Your treatment to far is nothing short of being wonderful. New growth started after three weeks treatment. Danders entirely gone. Scalp is toom, healthy and no on the way to a new head of late. My fears of baldness are gone forever. You may use my same and testimoutal. —A. McK., Lahr-view, N. J.

Hair About Gone

"I have now used your treatment 2 months and although I nearly lost my bair restricts and have been baid for 8 years, I was much surprised to see the Improvement it bus easier for me to this short time. I think ten times the price of what I paid lor it would not be any two winch for R. — N. R. H., Glen Cove, N. Y.

Results Very Gratifying

"I have used your Thermocap Trustment for a weeks and abbrough the top of my head has been entirely hald for 6 years, the results up to the present are very gratilying. In fact, the entire hald spot is covered with a fure growth of bale."—W. A. C., Kenmore, O.

pera and other centers of stientific research. And I believe that—for the first time in the history of dermatology—my method provides a means of penetrating directly to starving hair roots and supplying them with nourishment to make them grow new hair.

Results Guaranteed Or No Cost

Already at the Merke Institute, Fifth Avenue, New York, which I founded, prominent stage and social celebrities have paid as high as \$500 for the results secured by personal treatments. Yet now through my new home treatment these very same results may be obtained right in your own home, and for just a few cents a day! The treatment may be

taken in any home in which there is electricity. Hundreds of men and women who only recently were suffering from loss of hair have through this method acquired hair that is the envy and admiration of many of their friends. And as for dandruff and similar scalp disorders, they usually disappear after the first few treatments. Remember, I do not ask you to risk one penny. You try it on my absolute GUARANTEE that if after using my treatment for 15 minutes each day for a month you are not more than delighted with the growth of hair produced, then I won't keep a cent of your money.

Free Booklet Explains Treatment

If you will merely fill in and mail the coupon below I will gladly send you—without cost or obligation—an interesting 32-page booklet, describing my treatment in detail.

This bouklet contains much belyful information on the cure of the hair—and in addition shows by actual photographs what my treatment is doing for others.

No matter how much hair you have lost, this booklet will prove of deepest interest to you. So mail the coupon no w-and it will be sent to you by setura mail.

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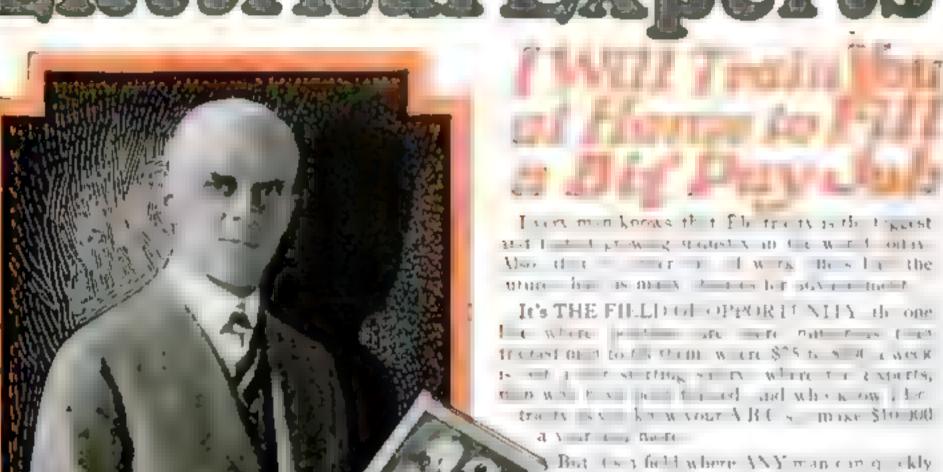
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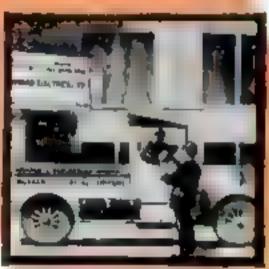
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More Mency Making Opportunities on pages 4 to 25

A Problem in Invention Can You Solve It?

This simple test will show whether or not you have inventive ability; thousands have it and do not know it, or do not develop it. Yet invention is the easiest way to earn a fortune. No technical or scientific knowledge necessary. Read below a few instances of how little ideas have made millions of dollars for their inventors.

NW would you like to get the royalty paid to the inventor of the tim cap used on millions of bottles? How you thought of the ample sies of putting rubber tipe on pencils? Wouldn't you gladly be the inventor of the Conette Safety Rasor ONE HALF MILLION DOLLARS a year The inventor of the tiny man-fastener recently paid an income fee of \$29,000 or be the man who invented the President Suspenders who be now worth \$5 000,000. The inventor of the a tegraphic attachment for cameras sold his patent rights for \$300,000.

Ideas Worth Fortunes

One single idea-no simple na any of these can make you in-dependently wealthy in a short time. Other inventors have made hundreds of thousands of dollars from such common things as the crimped hour-pin, the metal-tip shoe loce, the paper safety masch, the ordinary wire paper clip. These are certainly not compli-cated inventions—they are so simple in last, that probably thousands of people throught of them but only one man DID any thing about the idea when it came to him

You too, probably have ideas for needed inventions—and the only reason you have not turned your furnit until gold in because like thou as his of other sens on you doubt your own ability

to be ent. Or like he at persons, you believe that an Inventue quet be foun that every avenue is a man of gentle who events the base as beturally as other people do the swork as bookseepers, mechanics, ductors of farmers.

Invention Can Be Learned

But this to not true. What were our great loventors before they invented anything? n teacher. Edison was a telegrapher. Gillette and Venterman were traveling salesmen. Retter proof than this is that you can set all yourself that a vention is not limited to genuses or that it is incircly guesswork such or chance. You can pe we to yourself that invention may invention from the collar battom to the coloural rational engine.

the result of the same kind of Crought that you the to adding a row of figures.

Just think for a mount of what you do a may example a addition. You see a problem the row of figures. You recognize that a result is wanted he man of the figures. From these two facts that are alread and out the result. you go alread and get the result. And because only me knower can be correct for that particular you find that answer.

Proof YOU Can Invent

Exactly the same thing is true in invention. This is the proof. At the top right-band covers of this page is shown a simple problem in inves-tion. What would you put on a shall. A "to force thembers. B B "to move back at the same time. A little thought will show you the correct answer within a few minutes.

This test of your inventive abil-Ity simple as it is illustrates the thought behind every invention. Like your ar binetic example you see first a problem to be fixed. Then you think of something which will he it something which is the only correct answer to you problem.

That he all that he coverage to invention, brought down to its plainest definition invention in merchy the misches of daing things.

And how many times a day you do for though " A leaking fauret a ratting window a wabbily table-you as hundreds of things he these every year And though you may never have traitered it, every time you has though you one the very definite smet principles which are the

beste of Inventive Science.



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What Edison Says

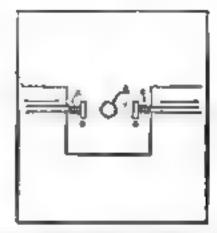
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Here is an interesting little problem in inven-tion. Its solution will be found very simple. If we really think.

"h is the end of a shalt. The two members is in are free to move a either direction toils cated by the arrows. If they are pushed back, the appraga "CC" will immediately pull them. forward again.

Our problem is to put some kind of an eltachment on the revolving shaft." A set that the members. B.B. was se pushed back both at the some material every time the shaft. A makes a magle revolution. The device on shaft. A" makes a made tevolution. The device on shaft. A" makes a made tevolution. What would you suggest justing on the shaft. A?

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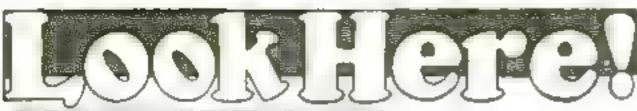
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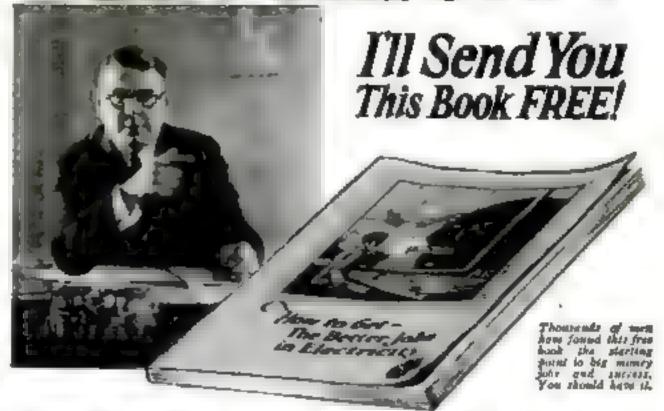
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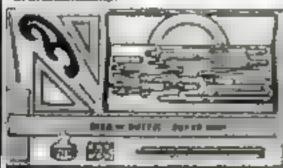
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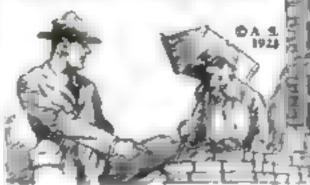
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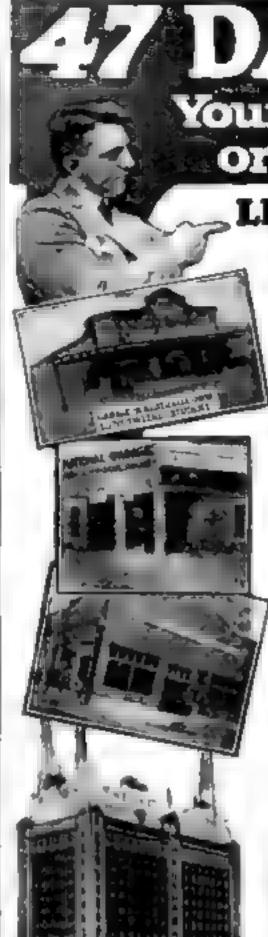
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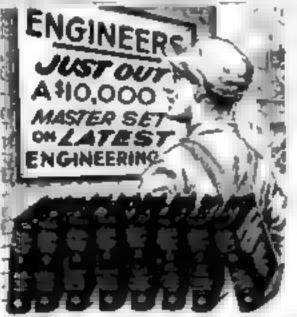
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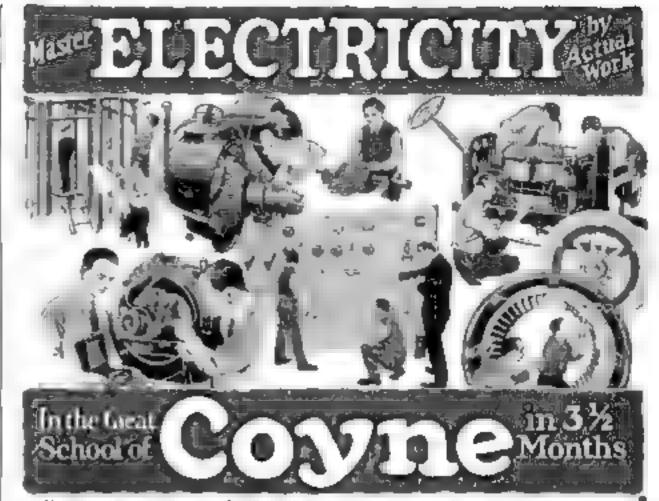
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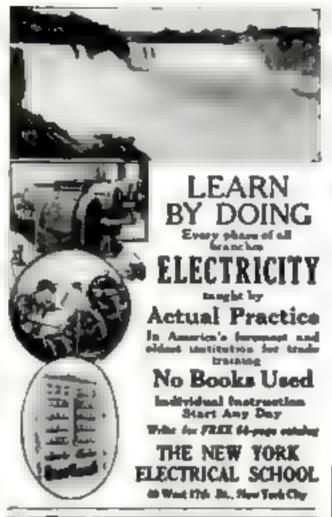
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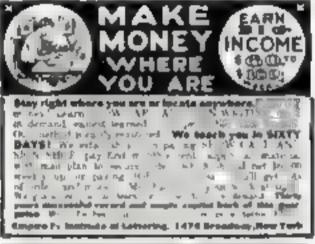
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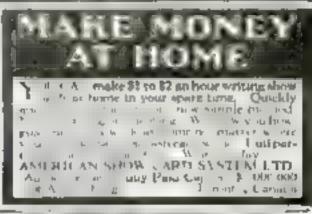
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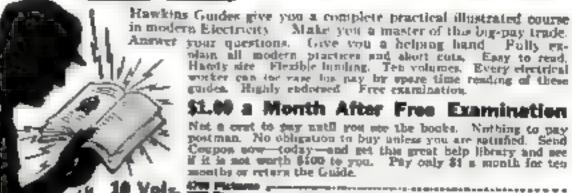
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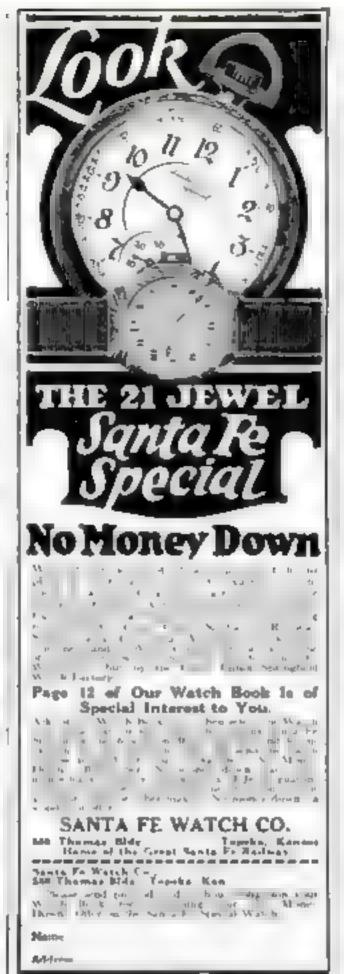
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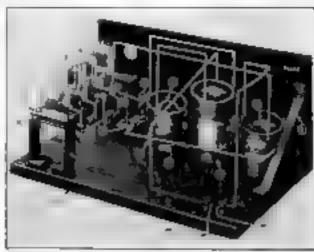
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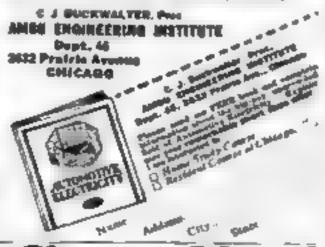
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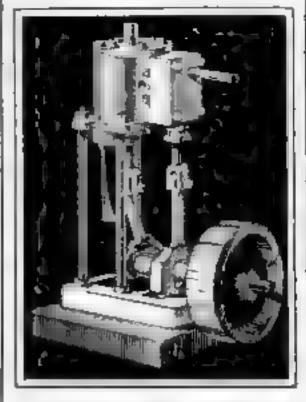
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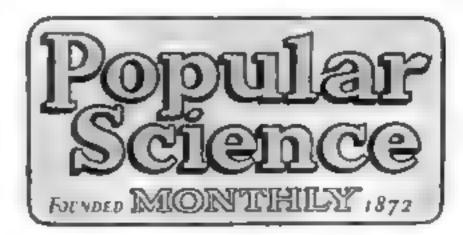
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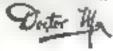
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Forming rapids of the Niegars River. In the new project to put the tides of the Bay of Fundy to work, a tidal stream equal to this in volume—122,000 cubic feet a second—will be poured continuously through a power power to generate 400,000 electric horsepower.

Niagara's Power from the Tides

By René Bache

Washington, D. C., now has under consideration a new project for harnessing the tides of the Bay of Fundy, at the northeast corner of the United States. It is said to be the first really practical plan for a large-scale tide-power development in this country

We are harnessing our rivers, and, with the help of wonderful new machinery, are converting the energy of their flow into electricity for industrial uses, for illumination, and even for operating tailroads. The eventual possibilities of such bydroelectric developments are gigantic. Nevertheless, they have an ultimate limit, which engineers already are able to estimate with a fair degree of definiteness. The power the tides could furnish, on the other hand, is limited only by the vastness of the seven seas and by the eternal journey of the moon around the

Control and use of that power is the next great epoch-making achievement that mankind may expect. Discovery of a means whereby this can be accomplished will elevate civilization to a new plane. It will mean that all of our factories can be run by the tides; that our cities can be lighted and our houses heated by the unfailing moon!

The moon? Exactly so. For it is the moon's attraction that makes the tides. If we can make the tides work for us, we shall in effect be harnessing the lunar orb to supply the demand for power that now is draining the world's limited fuel resources.

As a matter of fact, the thing was accomplished successfully long ago. Formerly along the New England coast there were tide mills operated in places wherever an injet could be dammed conveniently, with a pond to hold the water that flowed in on the rise of the tide. Power was derived from the flow of the water into the pond and out again, driving a large paddle-wheel. It was continuous power (used for small sawmills and flour mills), thanks to a most ingentous arrangement by which the current that drove the wheel was made to run in the same direction all the time, whether the tide was coming in or going out.

UPON a principle similar in effect, is based the new project for putting the tides of the Bay of Fundy to work. The plans include the building of four dams, with a total length of five miles, across the outlet of Passamaquoddy Bay and Head Harbor, thereby creating two pools, upper and lower, with a power



A bird's-rye map, showing the proposed tidal power project at the flay of Fundy. By a series of dams, two poets upper and lower would be created, with a power house between them. The rising tide would be permitted to past through a system of gates, drawing the turbines at the power panel, and filling the upper pool. During ebbtsde the sower pool

would be permitted to empty itself into the eea, while a stream equal in volume to a great river would pour out of the upper pool through the power house, continuing the drive of the turbines. The plan simply is an eleboration of the primitive New England tide mill illustrated below. It would supply electricity to Maine and sentern Canada

house between, as shown in the illustration above.

It is proposed to install a system of gates that will permit the floodide to pour into the upper pool, and allow the lower pool to empty itself at ebbtide. By this arrangement a stream equal in volume to the Niagara River will be poured continuously through the power house, driving turbines that are espected to generate enough electricity to supply a large part of Maine and eastern Canada.

The tides in the Bay of Fundy rise and fall through a range of from 35 to 45 feet—one of the greatest tidal ranges in the world. At the power house an "operating head"—never less than 16 feet and running as high as 27 feet—will be maintained. From 400,000 to 500,000 continuous electrical horsepower will be developed.

THE upper pool, about 16 miles long by 10 miles wide, will be reparated from the lower by a dam between the Mains shore and Deer Island—the power house to be close by this dam—and by two dams connecting Deer Island with the New Brunswick mainland and Campobello Island, respectively. A fourth dam, to impound the lower pool, will bridge the gap between Campobello Island and West Quoddy Head.

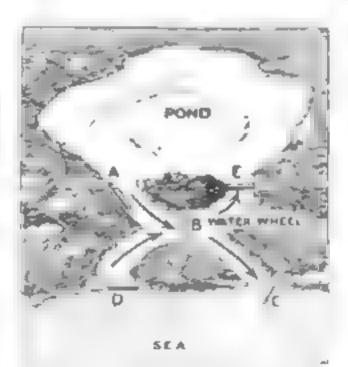
The lower pool will be somewhat less in area than the upper one. Locks are to be provided at the dama connecting Deer Island with Campobello Island and the mainland of New Brunswick, permitting ships to pass from one pool to the other

Tides in the open ocean rise and fall with a maximum range of three feet; but the waters of the sea, rushing at flood into an estuary such as the Bay of Fundy, are literally piled up, so that in that great bay the difference in level between the high and the low tide sometimes is as much as 45 feet.

The idea back of the tremendous superpower project in that the flood at each rising tide shall be allowed to pour through opened gates, filling the upper pool. During the rise it will drive the turbines at the power dam. During the cub the lower pool will be permitted to empty itself into the ocean, while a stream equal in volume to a large river pours out of the upper pool through the power house, driving the turbines.

The turbines will operate huge dynamos. And, since the supply of power will be continuous, there will be no pause by day or night in the production of electricity, which will be distributed by wires over a vast area (or industrial and domestic times.

All this useful energy will be captured



How the simple New England tide mill operates. A smell pood serving as a reservoir is connected with the sea by two channels that cross each other. A water wheel is placed at the engineerised of the channels. During the cutflew of the ride the gates at A and C open as above supplying current to the water wheel B. At the same time the gates at B and E automatically close. During the influst the gates at A and C close and D and E open, producing a flow through the wheel in the same direction as before. Thus the power is continuous during both phases of the tides

indirectly from the moon. Oddly enough, few people realize how big the moon is. Its diameter is a little more than one fourth that of the earth—2168 miles, to he exact—and its attraction is so great that it causes two great waves in the ocean, on opposite sides of the earth, to travel around the globe once in 24 hours. These waves make the tides. The sun's attraction is concerned incidentally, for it causes extra high tides when in a position to help the pull of the moon.

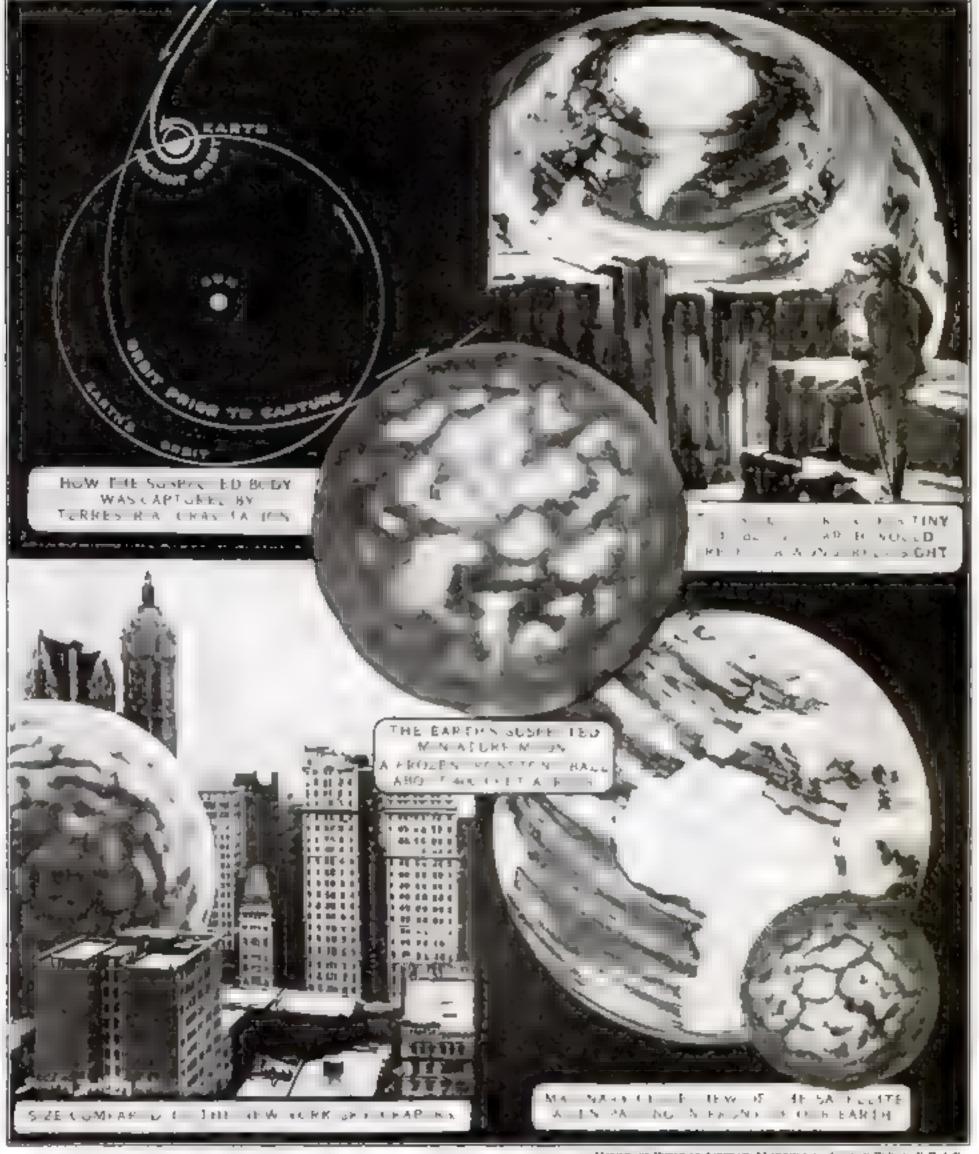
THE tides represent unlimited power going to waite. But tide-power developments are practicable only where the tide enters an estuary and, with a piling up of the water, rushes up a channel. This phenomenon, conspicuously illustrated in the Bay of Fundy, is called a "tidal boro."

Developments for the utilization of tidal power are in practice limited to localities where natural facilities are favorable for creating tidal basins, where portions of the flow can be impounded and controlled, and where conditions are suitable for the erection of power plants similar in character to hydroelectric stations.

All this, of course, applies to large-scale developments. Small tide mile were in use in England as early as the eleventh century, and also in Brittany. In a simple form, such an installation can be made by placing the power plant between two channels connecting the sea with a reservoir basin, as in the New England power mil. One channel is closed while the basin is simplying. The flow can be utilized coming and going

The water wheel, which dates far back in history, almost undoubtedly was a Chinese invention. Probably the same is true of the tide mill. At present there are many such mills in China, located on small tidal creeks, and used for cleaning and "polishing" rice.

(Continued on page 13.1)



Has Our Earth a Second Moon?

By Scriven Bolton, F.R.A.S.

F YOU are interested in popular astronomy and if you own or have access to a small telescope, you have the opportunity of a lifetime to make a momentous discovery, one that might eclipse the discoveries of the world's greatest observatories. You have a good chance to find a suspected second moon to the earth-a comparatively tiny meteoric ironstone ball some four or five hundred feet across, without atmosphere . passes across the solar or lunar disk. If and frozen to the core.

This strange little body, pulled from its course by gravity, is believed to revolve around our earth once every three hours, traveling at a speed of about 314 miles a second. Its orbit may lie about 2500 miles from the earth's surface. A modest three-inch telescope should reveal it,

Watch to see if a small black speck ever the suspected second moon really exists. it is reasonable to assume that occasionally it must pass between us and the sun and moon, moving rapidly acress in six or eight seconds. Reports have been received that such a body has been observed, but these must be substantiated.

Your LEGS-Yardsticks The Newest Theory of

Henry Ford Long-legged. short bodied type of man.

ligence, ought to be occupying important executive positions. You probably fan suggest other surilar exceptions Forth among your acquaintances

Science has found though, that the size and proportions of the hely appar-ently shoply a most reliable way of predicting the intelligence | Recently Dr Sante Naccarati, of New York City, wellknown arecialist it nervous and mental disorders, conducted a test of this theory among about 300 students of Columbia University. The results tend to show unmistakably that a very definite relationship exists between bodily structure and intelligence, this despite the fact that no very unintelligent individuals would be found among a group of college students. If unskilled workers had been included, the relation between intelligence and bodily development almost certainly would have been more striking

THE first group examined by Doctor Naccarati consisted of 75 men. Al. of them had taken a three-hour inteldgence test, and their standing in it was known. As a first step in determining their bodily proportions, the volume of te beight, breadth, and thickness and multiplying the measurements—exactly as you would find the volume of a box.

Then the volumes of the upper part and liwer part of the abdomen were determined in a similar way, and the three volumes added together to give the volume of the entire trunk

Next, the length of one arm was measured from shoulder to wrist, and the length of one leg from hip to ankle, and these lengths added. Finally a relation was established between the combined length of limbs and the especity or volume of the body by dividing the former by the latter. The result is called the "morphologic index," or guide to bodhy structure. It tells instantly to what

bodily type a man belongs, just as dividing a man's weight by his height would tell you whether he is too light or too heavy for his height.

Measurements in the test were taken in cuptumeters, and it was found that the students varied in morphulogic index between 350 and 750, those with a high index belonging to the musil-bodied, long-legged type, those with a low index

belonging to the large-bodied, shortlegged type. If the measurements were in inches, the index would vary between 022 and .048.

T MAY be noted here that the morphologic index is approximately the relation of height to weight. This means that you can determine your bodily type roughly if you divide your height in inches by your weight in pounds and multiply the result by 100. If the result is more than 50, you belong to the smallbodied, long-legged type. If it is between 50 and 35, you belong to the normal type. If it is less than 35, you are of the largebodied, short-legged group.

Our tests showed that the morphologic index is not a 100 per cent guide to intelligence. For example, one student belonging unmistakably to the large-hodied, short-legged type, proved to be one of the best students in his class, while at least three others of the group examined, though having the small bodies and long legs that betoken intelligence, have been



Orville Wright Long-legged, whore-bodied type

F YOU have a small body and long arms and lega, the chapter are that you are highly intelligent and will find success in some kind of brain work

If you have a large body and short arms and legs, brain work probably is not your forte, and you would do best to follow some manual trade, or at least a line of work requiring steadings and accuracy rather than quickness of mind.

If you are of a normal type—that is, if your limbs are not disproportionately long or short in comparison with the size of your body-you may be aither intelligent or unintelligent. Whether you are united for brain work or manual labor cannot be told accurately from your bodily messurements.

These in effect are the conclusions science has reached as a result of the latest investigations in the field of physiological paychology. You will notice that I have not stated that intelligence is an attribute of only small-bodied, long-limbed men One of the most brillant men I know, a scientist of international reputation, is squat and short legged, and probably would be working as a day laborer if the classification given above held true in all

On the other hand, within my sight as I write this is a gang of a dozen laborers. two of whom are long-legged, long-armed, short-bodied men, who, if bodily conformation were an infallible index to intel-

Four Outstanding Men

N THESE pages are pictured the four Americans recently selected by Prendent M. L. Button. of the University of Michigan as the outstanding men of the twentieth century Two of them—Henry Ford and Orville Wright belong to the long-legged, short bodied type of man, a type which according to the new theory explained by Doctor Carrett in the accompanying article. indicates high intestigence. The other two-Thomas Educa and Theodore Roosevelt -belong to the normal type, midway between the longlegged and the short-legged types. Note that the short-legged type, said to indicate low intelligence, is not

Whether or not you agree with the new theory of the relation of statute to antelligence, you will be interested in the results of its application in scientific laboratory tests, as described. by Doctor Carrett

of BRAINPOWER

Intelligence By Henry E. Garrett, Ph.D.

forced to leave callege on account of scholastic deficiencies since the test was made.

But on the whole, comparison of the bodily measurements of the students with their tested intellmence showed undoubtedly that so far as the possession of general intelligence is concerned, the chances are very much in favor of the man who possesses a arnall body and long legs.

OF THE 75 men examined, 35 showed high intelligence, 19 of these from the 25 who made up the small-bodied, long-legged group. Only six of this group showed medium or low grades in the intelligence tests. Of the 37 who made up the normal group, 14 showed high interligence and 28 medium or low, while of the 18 large-bodied short-legged men examined, only two showed high intelligence.

Expressed in percentages, the results mean that 76 per cent of the amail-bodied, long-legged men, 40 per cent of the normal men, and 15 per cent of the large-bodied, short-legged men showed high Interligence.

The results of this first experiment were no favorable that, in order to test further the resultonship between bodily structure and

Intedigence, Doctor Nuccerationum-Ined another group of 221 men. The same general result was obtained

It is surprising how thoroughly Doctor Necessati's conclusions seem to be borne out in the case of many wellknown men. Henry Ford, John D. Rockefeller, General Pershing, Booth Tarkington, and David Wark Graffith might be named as the outstanding Americans of this generation in their perticular fields. All of them are long-legged men with short bodies.

7 ASHINGTON and Lincoln and Woodrow Wilson likewiss were of this type. President Coolidge, the late President Harding, Andrew W. Mellon, Secretary of the Treasury and one of the world's leading bankers, and William G. McAdoo, former Secretary of the Treasury, also must be included in the smallbodied, long-legged class. In the world of invention, Tesla, Marconi, the Wright Brothers and a boat of others are typically long-limbed men with small bedies

Edison belongs to the normal type. So did Theodore Roosevelt. So does David Belaeco. Charles Evan Hughes and Eliku Root appear to be of the normal type, though removed from the short body, long-legged type by a narrow margin.

Nobody will deny that all of these men are of superior intelligence, yet all but two or three of them are small bodied, longlimbed men.

The names of two other men occur to me—Jack Dempsey and Luis Angel Firpo. They are almost as well known as any of

the eminent men I have mentioned, yet not even their staunchest admirers would claim that they possess as much intelligence as any of those named in the previous paragraph. Both of them fall in the class of large-bodied, short-legged men

of the low normal group.

Now, this relationship between bodily proportions and intelligence cannot, of course, be merely accidental. There must be some scientific reason for it. V.ola, an Italian scientist, offers the opinion that the man with the small body and long legs has advanced further in the scale of



Thomas Edison Normal type

How to Test Yourself

'O FIND whether you belong to A the long-legged, short-legged, or normal type of man, first measure the volume of your trunk, dividing it in three sections:

 Measure length of cheet bone. depth of cheet, and width between armpite. Multiply dimensions.

2 Measure from chest bone to end.

of rilm, width and depth of middle cheet. Multiply dimensions. 3. Measure from end of ribe to hip

bone, width and depth of want. Multiply dimensions.

Add these three volumes to obtain total volume of trunk. Now measure the length of one arm and one leg.

Drvide combined length of arm and leg by total volume of trunk. The remorphologic index "If this is between 035 and 022 you belong to the short-legged type of between 035 and 046, to the long-legged type. Normal is about 035



Normal type

evolution than the normal man or the man with long body and short legs, just as the animals we know today show in their bodily conformation and abundant brain capacity an advance over the huge, unwieldy, short-legged prehistoric monster-

The most tenable explanation, however, is based on facts given by endoerinology - the study of the ductless glands; those mysterious little organs, which through their internal secretions have been found to influence mental and physical growth. Probably the best known of these is the thyroid, which is in the neck, close to the windpipe.

DERSONS whose thyroid glands are active usually will be of the smallbodied, long legged type. They are likely to be alert and active, to have a vivid imagination and a good memory. Sometimes they are excitable, and, if their thyroids are overactive, they often are dreamers and theorists, rather than doers.

The large-bodied, short-legged man, on the other hand, is likely to have a thyroid gland that is not especially active. Though he often has greater endurance than the man with small body and long limbs, he is slower mentally and physically. This type often makes the cautious hard-headed business man-the doer rather than the thinker or dreamer.

Storming Earth's Highest Citadel

Mount Everest's Desolate Summit a Challenge to Man's Endurance

By Raymond J. Brown

OMEWHERE on the Tibetan plants a band of a dozen explorers is pushing forward on the first leg of a most tremendous adventure. They are preparing to storm the loftiest citadel Nature has reared on earth-Mount Everest, whose snow-capped peak rises 29,141 feet above the sea, dwarfing the surrounding mountains of the mighty Himslayas. Preparations for the actual secent were completed early this year

The expedition is under the auspices

of the Mount Everest Contmittee of London, England, and is the third attempt to scale the mountain. All its members are veteran climbers. One of them. George Leigh Mailory, took part in both the previous assaults on this desolate spire of the earth. Another, Capt. Geoffrey Bruce, brother of Brig.-Gen. C. G. Bruce, commander of the expedition, shares with Capt, George I, Finch the distinction of having ascended, in the last attempt in 1822, to within 1700 feet of the summit a height of 27,441 feet. This is the greatest altitude ever reached by man, except in an mirplane.

As a result of the two previous expeditions—a reconnuissance in 1921 and the actual attempt to reach the summit in 1922every aid that science and ingenuity can contribute has been summoned to insure the success of the present venture and to guard against accident.

The approaches to the mountain and the paths to be traversed by the expedition in its climb have been mapped and charted. Supply camps have been located at points most advantageous to the chrabers. The equipment includes everything that will contribute to comfort and safety and conservation of strength during the tortuous ascent

OXYGEN, for example, is to be carried to the climbers in tanks to compensate for the deficiency of this life-giving gas in the rarefied air enveloping the upper portions of the mountain. The members of the expedition know that they can climb to within about two miles

of the top with relatively little difficulty. They are reasonably certain, after the spectacular feat of Captains Bruce and Finch two years ago, that the most hardy of them can ascend a mile and a half farther. But the last half-mile-can they conquer that? Nobody knows.

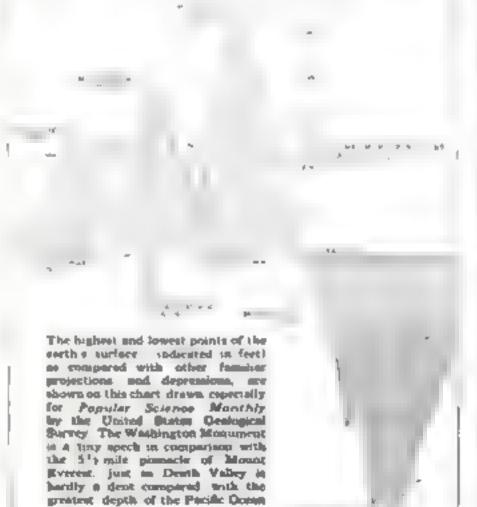
Nature controls the situation through the physical capacities with which she has invested man. Can a man at a height greater than 27,000 feet, develop the energy to walk or drag himself higher?

In scaling a precipitous mountainaide, covered with ice and snow, possibly un-

> der the necessity of cutting a foothold for himself with every step he takes, a man uses up a tremendous amount of energy. He literally is burning up the tissues of his body, a loss that can be made up only by the oxygen he breathes. The atmosphere near the summit of Everest, containing less than half as much exygen as the atmosphere at sea level, cannot supply the lom. Consequently, the normal functioning of the body is interfered with periously

The principal factor, then, in the amount on the heights of Mount Everest is the physical ability of the members of the expedition. Natural obstacles, of course, are there in plenty. The sheer alopes of a mountain more than five miles high would present almost overwhelming difficulties to the climber even if the atmospheric conditions did not offer their peculiar hazards, as in this instance.

Snowslides and landslides cause the topography to undergo extraordinary changes. tremendous snowslide in the last expedition took the lives of seven

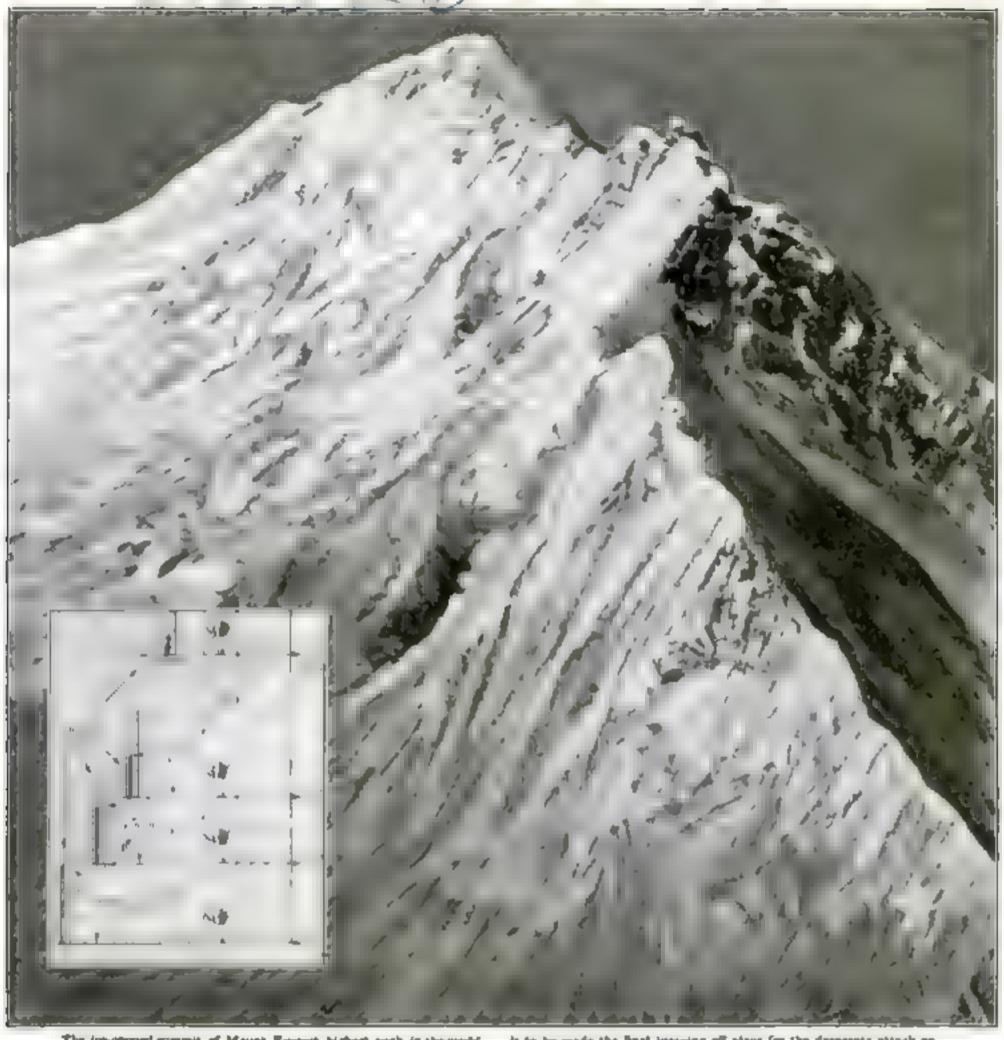




market bed an agent of the T

Members of the 1912 expedition lighting their way step by step. 19 the trenchemus slope of Mount Everest. The clumb is one long, thistoom test of human endurance. The adventurers not only must time up tremendous bodaly energy scaling precipitoes are covered slopes, in constant perd from mornishes landslides, and terrific storms, but their strength is supped by lack of exygen in the air

Pausing for a brief rest during the ascent. Climbers of the 1922 Everest expedition are shown wearing smoked glasses, their faces conted with lampblack, as protection against the danger of snow blindness. Strange as it may seem, while the terrific cold sape their wannes strength and nips at their hands and feet the sun beats down with terrific intensity. They are always in danger of sunstroke



The ice-capped symmit of Mount Everest highest peak in the world, which twice has delied the attempts of men to stale its desiate face. This remarkable photograph shows the rugged slope up which that third especiation this summer will attempt to make the final desh to the top. The mountain consists of a meetive central pinnacle from which radiate five index four in the northern area and one on the southeast. The songest ridge to the north, culminates in a secondary spur known as North Peak separated from the central peak by a nerrow, wind-swept page. This depression, 23,000 feet above see level,

is to be made the final jumping-off piece for the desperate attack on the summir

The inner illustrates how the diminishing atmospheric pressure at increasing altitudes indicated as round numbers, causes the barometer in fall and ceduces the boiling temperature of water with the result that while the water octually may be boiling, it is not but enough to cook meet, potatoos or other foods. This condition is encountered even before the 15 000-foot abitude is reached. The boiling point drops about one degree Fahrenbeit for every 590 feet that is chimbed

native aids. Fierce gales of almost unbelievable velocity aweep about the upper portions of the mountain, where the snow is dry and soft as sand. But the greatest difficulties of all are those that arise from the natural requirements of the human body

Take the matter of food alone. The climbers are limited in the kind of food they can take, not so much because of the difficulties of transportation as because of the difficulty of cooking it. The builting point of water drops one degree for each 590 feet the water is carried above sea.

level. At sea level the boiling-point is 212" F. At 15,000 feet it is only 184 degrees, and near the summit of Mount Everest it drops to approximately 168 degrees.

So it is that vegetables and other foods that the members of the expedition are accustomed to eating boiled cannot be boiled when at an altitude above 8000 feet. The water will boil away without becoming but enough to cook the vegetables. This makes it necessary for the members of the expedition to eat food to which they are unaccustomed, a factor that is bound to exert an effect on their physical powers.

The low boiling-point of water at high altitudes also makes it impossible for the climbers to foster their faltering strength by the stimulating effect of hot drinks.

Then there is a condition called "mountain sickness" to which even the most experienced climbers are subject. None escapes it, it is said, once an altitude of 20,000 feet or so has been attained. This malady undoubtedly is related closely to the breathing of rarefied air and the con-

(Continued on page 141)

Adventures in Home Ownership

Chapter II How We Financed Our Purchase

The story of the first adventures of Jim and Marion Hunter in their search for a ready-built home was told entertainingly by Mr Riley in last month's issue After inspecting a number of houses that offered such objections as careless construction, old age, and undesirable neighborhood Jim and Marion finally found their heart's desire, only to discover that the price apparently was beyond their reach. Now read on

EN thousand dollars!" exclaimed Jim Hunter, repeating the price of the house that they had hoped to buy-the price his wife had read from the realestate list. "Whew, Marion, that's a lot of money, lan't It? "

"Well, a lot more than we've got,"

she admitted ruefully

"Unfortunately, one gets but small houses for big money these days," I reminded them.

Marion was quick to sense the imminent collapse of her hopes in the tone of Jim's voice, but evidently was unwilling to give up

"Of course those are asking prices." she said, pointing to the list and appealing to me. "Do you suppose the owner of this house could be induced to take less?"

"Possibly a few hundred less for all cash," I told her, "though hardly more than \$500 and probably not nearly so much."

"Even so, we haven't half enoug money!" she wied in obvious despar-"Oh, Jim, lan't it wretched to be so poor?

The expression of Jim's face as he watched her seemed to register several emotions. I thought I could read in h eyes genuine sorrow, burt feelings, and a aparit of tolerance

"IT IS, little grel," he agreed gently "but fortunately I have prospects Don't forget that "

Then he turned to me

"On what terms do you suppose I could

buy the house?" he naked

That depends on how much money you can put into it at the start," I told him, "The more the better, because the carrying charges are so much less. With 40, 30, or even only 20 per cent of the purchase price in cash, you usually can buy any house, for some bank or loan association will carry the balance as a loan secured by a first mortgage. I have known persons to buy their bomes with little or no cash, but it is an unsound practice, usually resulting in an overwherming burden or even financial duaster "

"What proportion of the investment is a bank generally willing to carry?" asked Jim

I explained that most banks prefer not to carry more than 50 or 60 per cent of the total value, and under some state laws cannot do so. Yet building and loan associations will carry as high as 80 per cent. I pointed out that, if necessary, By Phil M. Riley

Noted American Authority on Architecture and Building

part of the amount can be carried on a short-term second mortgage, which the bunder or owner may take, otherwise some private investor. But the rate of interest would be higher and a bonus or

commission up to 10 per cent sometimes is charged. The robbem" Marion

interrupted Not at all," I nasured

he balance of \$6000 on a first mortgag Won't it be splendid?" cried Maria Yes, but what is it going to cost us earry the home?" Jou asked Wed," I explained, "briefest Bat amortization at the rate of 12 per cent & the total lann around y, most in g t at 6 per cent, will one r you to whole debt in about 12 years 1 to \$720 g year " that leg word rouge?" War a with a puzzled frown 12 2 A r a in a limite term for paying back the principal of the loan. To you it means the death of the low funny," she laughed Faxes, issurance, and upkeep," 1 went on, "probably would be about \$400. s year, making a total annual expense of \$1120.7

confided

provident thing to do. It deprives your

family of the full protection your life

insurance should secure. But very likely

you could pegotiate a real-estate mort-

gage loan with your insurance company

Many companies engage in such business

while at the same time discouraging policy

\$4000 to put into a home." Jim finally

"Getting down to facts, we've got just

FINE," said I. "That being the case,

we can easily get a bank to carry

and are entitled to a higher return to cover occusional losson. Buildenroll ten have to set T 1 7 7 7 7

low their face value to obtain more money for carrying on their bundness. The good character of R home-seeker usually enables him to secure a second mortgage on reasonable terma."

Jim auggested that he might borraw some money on his life insur-

"No doubt you could," I agreed, "yet it's an im-



The Architectal Small (Logar Bureau of the United States, 100.



This unusually compact yet artractive six-room semi-bungalow of the English-cottage style Jim and Marion found to be a model of economical planting, with many labor saving devices, yet unsurted to their tastes. In most localities it should range in cost from \$7000 to \$8500.

POULTE SCHOOL MONTHLY

shoulder I read the following summing

\$720

us of his expenses:

Int and amort...

"To which ought to be added my loss of \$180 savings-bank interest on \$4000 at 4½ per cent," Jim added.

"TRUE enough," I assented: "but remember that of the \$1120 annual expense only \$760 would be comparable with rent the first year. The other \$360 really would be savings, an investment you might call it, appued to reduce the principal of the loan. A man ought to save for some sort of investment at least from 10 to 15 per cent of his income annually, and this is a good way to save part of it. Don't forget, also, that these savings grow larger every year as the principal of the debt becomes less and the interest charges are reduced."

"The trouble is," laughed Jim, "that while a house is in a sense an investment, it pays no definite, regular interest. The

mavings put into it to reduce the principal of the loan are lost to us as far as possible use of them in time of need is concerned. The same is true of the interest on those savings, or \$16.20 a year at 41% per cent on \$360."

"But, Jym," Marion broke in. "It seems to me that the interest on a home investment takes the form of enjoyment of your own home while paying for it and of better living conditions for the children and ourselves. Besides, we might save something when you consider the rent raises profiteering landlords are making."

"I'm afraid we wouldn't,"

Jim objected

I pointed out to him that he could always raise money on his equity in a house, "I should say," be announced presently, "that to buy and maintain this house with what ready money we have we practically would be paying out \$1500 a year, as compared with the \$1200 our heated apartment costs us with water included. Deducting from this latter amount the two interest items we should be saving, or \$196.20, the figures show that this house really would cost us about \$500 a year more than our apartment."



An inexpensive Durch Colonial corrage of six confortable rooms and bath. J m and Marson decided to buy this botse because it offered the best for the money. It should cost between \$6500 and \$7500

Present a con a service to the house shown above to the factors flows there are the factors flows.

if he wanted to give a second mortgage

"Yes, and pay a high rate of interest for it," Jim wisely retorted. "I'd rather have savings in the bank and merely lose the 41, per cent interest on them"

I suggested that he ought to have both the house and some reserve savings in money.

"RIGHT you are," be agreed. "And another thing we mustn't forget in the fact that heat and water must be paid for in maintaining this house, both of which are now included in our apartment rent. Water would average perhaps \$20 a year. And wouldn't you say about 10 tons of coal at \$150, making a total of \$170 a year for these items?"

Here Jim got out his note-book and began jotting down figures. Over his "And that, I suppose, means we can't have the house," Marion sighed She was on the verge of team.

"I'm awfully norry, Marion dear," Jim said, laying a comforting hand on her shoulder, "but it really would be a hurden to m, I'm afraid. If there

were just you and I, we might manage, but the kiddles mustn't want for anything "

"It's such a dear place," Marion said sadly, glancing about appraisingly once more. "Jim, you've no idea how I'd be willing to economize on everything in order to buy it."

"You're a good little sport, Marion," he replied; "but economizing is the way we've accumulated our \$4000. There's a limit to that sort of thing and we've been suiting pretty close to it right along. I don't see how we could do very much better."

Realizing the probable wisdom of Jim's caution, I decided to find out more definitely what their circumstances were and to offer what seemed to me sound advice. Meanwhile I had been hastily consulting some copies of Manning and other family budgets, issued by banks, that I usually carry in my pocket for reference in such cases.

"Of course a man should have an anbual income of from \$4000 to \$6000 in order to buy a \$10,000 house comfortably," I bazarded, "and if he has children, it really ought to be \$5000 or \$6000."

"I'm getting \$4000 a year and, like many salaried men, have been violating the old rule not to pay more rent by the month than the amount of my weekly salary. But the boss has almost promised me a 50 per cent raise at the end of this year if our volume of business is maintained, and then this would be easy."

"For a family man with a \$4000 income, about \$100 a month ought to cover all home-carrying and operating expenses," I stated, referring to the chart in my hand. "Now

may I offer a frank, practical suggestion?" Marion and Jim nodded encouragement.
"Perhaps you'll remem-

ber," I explained, "that in looking at one house today I reminded you that even buying a home must be regarded as an investment with an eye to its resale value, just as in buying a car."

"I sure do," commented Jim, "and it sounded logical

to me "

'Frankly," I went on,
"this house is a little too much
for you to carry comfortably,
and perhaps it is unwise to
anticipate Jim's salary raise,
certain as it seems. About
double the annual income is

all anyhody should pay for a home. Why not buy a lower-cost place that you can carry comfortably, and when your income increases sell it and buy or build another? You would better your living conditions and I think I can guarantee that you will lose nothing. You might even make a little money by the sale, due to the growing demand for homes in this locality."

"THAT'S my idea to the last word!" exclaimed Jim. "But where can we find the house?"

To my recollection as we talked had come a development of several small houses near by, put up by a reputable builder of my acquaintance whom I knew to be satisfied with a fair profit and proud of giving good value for the price.

"I think I can find you one, or several, for that matter," I assured him con-

fidently.

"Let's go." urged Jim eagerly,

Marion, however, showed little intercut and was again looking about in wistful abbraisal.

"Let me tell you about these houses, Marion," I said, to divert her mind from her disappointment. "They're a good deal like this one, only a bit smaller. I feel sure you'll like them. And, Jim," I continued, getting each by the arm and drawing them together beside me, "they're only \$7000."

Continued on page 137)

Does Your Watch Know You?

How to Befriend the Most Temperamental of Mechanical Servants

FEW weeks ago a young man asked me to examine a large silver watch, a typical railroad man's watch: an axcellent timepiece, too, I knew as soon as I saw it.

"I bought this a couple of weeks ago." he told me, "and I'm afraid I've been stung I got it from a locomotive engineer who lives near me. He told me it hadn't gained or lost more than a few seconds in 10 years; that he'd been running a train



The habitual joits and pare of pounding typesetter keys are rusadus to watch servicey

by it. He said the only reason he was selling it was because the rangoad had given him a new watch. I thought I was getting a prize when I bought it from him, but It's been losing about two minutes a day ever since I began carrying

Even before I opened the case, I was quite certain there was nothing wrong with the watch, and, after making a hasty exumination. I told the young man there wasn't,

He looked at me blankly "But it hasn't been keeping time," he objected.

That's merely because you and the watch haven't become acquainted yet," I tord him. "The watch hean't

got used to your ways. For 10 or 16 years it has been carried by a locomotive engineer, and it has been used to the vibration of the locomotive. It has become accustomed to being carried at high speed in the temperature of a locomotive cab. It has been in the babit of starting out for the day at a certain time and of being put away for the night at a certain

"You probably work in a well-heated office. You get up later in the morning than does the engineer, and you go to bed later at night. Probably you wind the By Samuel Bernard Expert Watchmaker

watch at an entirely different time. The watch has resented being duturbed in its accustomed routes—it masses its conatant vibration and the only way it has of showing its objection in by remains

You talk as in the watch were alive,"

Lastly," Tagreed "Of all mechani-Avievices we use, a watch comes nearest to having life, senses, and feelings. It reacts to cold and heat, dampness and dry air, recognises good treatment from bad. in fact, it's as sensitive to the way it is cared for as a pet dog would be.

"A watch even has temperament which it acquires rapidly according to the temperament of its wearer. That's the trouble with your watch. Your temperament is different from that of the former owner, and the watch hasn't had a chance yet to adapt itself to the way you do things. Give it a little more time to get used to you and your ways. Just move

the regulator hit to correct the time that the regulator a bit to correct the time that
the watch is sosing now. You can do that
as well as I could do it for you—and I'm
sure you'll and the watch adjusting itself
to you'll and the watch adjusting itself
to you'll analyou while "
That young man's attitude was typical
of the average watch owner. When you
buy a watch, you expect it to keep perfect

time. If the watch fails to do so, it never occurs to you that the fault may lie in yourself---in the way you treat your time-



Hanging the wetch near an open window, exposing it to demp sir, flists the peris

piece. After all, with the

progress that has been made in watchmaking, perfect time can be expected of any modern watch-even of the cheaper types. But a watch ts the most delicate and complex mechanism of daily use. It has 212 parts, some so small that they are just about visible to the unsided eye. A break or a maladjustment of any of these parts is sufficient to mar its utuity as a timepiece. Small wonder, then, that watches function as well as they do. considering the careless, indifferent way we care for

Have you ever considered what a really marvelous device a watch is? To make one requires no fewer than

3735 distinct operations, involving about a year's work. Many of the parts connot vary so much as one two-thousandth of an inch in any dimension. The balance wheel alone requires scores of operations by the machines used in its manufacture, Yet, perfect though the machinery is, it is impossible to produce two balance wheels of exactly the same size and weight! They must be weighed after manufacture and sorted according to size.

themi

Part of the mechanism strikes 18,000 blows an hour-157,000,000 in a year.

[Continued on page 142]

How to Make Your Watch Keep Good Time

MR. BERNARD BAYE:

After you buy your watch, have it regulated to fit your gait

Treat it gently Don't drop it One bad fall may

See that it is oiled once a year.

Guard it against jolts and jare. If it is a wrist watch, don't wear it while pounding typewriter

Keep it away from dampness. Don't lay it down or hang it up near an open window especially

Never open the back of the watch out of doors, or where the air is full of dust.

In closing it, never press on the center of the case. When carrying your watch in your pocket, keep the face next to your body for protection.

Wind your watch every 24 hours, and at exactly the same time, to the minute, each day.



Be excelal not to drop your watch. Ope full may rain it as a timehosper



Triple-deck strest corner in the growded city of the future—a solution of the ever-increasing traffic problem proposed by Harvey Wiley Corbett, president of the Architectural League of America. Streets

would cross one under the other thus diminating cross currents of vehicular traffic. Pedestrians would use on cirvated sidewalk, bridged at all streets in both directions, unding the closh of foot and wheel traffic

Can Science Save a Crowded World?

By Lieut.-Comm. Fitzhugh Green, U.S.N.

"Parks of Polar Flight"

AVE you ever been caught in aubway jam or a football crum and have gon felt that little stirctive shudder of pritate it at being pushed hither and thither against your will by other until y mortals just as helpless as your a

A hundred bears from now the whole of life may be like that!

The population of the earth has doubled in the last 90 years. Today it is estimated

at 1,747,000,000.

America has done her shore. Our recent United States Census Report says: "The net add tion to the nation over deaths and departures for the last 10year period (1910-1920) averaged nearly 4000 persons per day"!

Increase the perspective and the figures

are even more astounding

The population of the United States has been doubting itself approximately each 30 years during the last century. It

orld we live in: add a touch of speculation on the rushing wonders of science; couple these with the keen mind of a brilliant naval officer, and you have this startling prediction of an amazing world future.

was 25,000,000 in 1850, 50,000,000 in 1880, and 100,000,000 in 1910. If this rate of increase continues, it will have grown to 700,000,000 in less than 100 years!

Statisticians of Johns Hopkins University, after careful computation, tell us New York will pass the 12,000,000 mark by 1933. By the end of the century its population will have reached the huge

total of 29,000,000 inhabitantal Angeles, which is growing three times as fast as New York, may then count 40.000,000 sunburned Californians?

They make you a little breathless, don't they, those figures? Like watching the Twentieth Century Limited go whisting by; only thus one keeps on whizzing

And all humanity is aboard!

One view of this satounding problem still widely held lies in what is known as the "Malthusian theory." Robert Malthus was a Jesuit priest of London." In the year 1798 he started an argument on the subject of population that still is far from ended

Mathas viewed man's future on the earth with melancholy eye. He held that the race multiplies faster than its means of subsistence can be made to follow; that ultimate famine is inescapable. Whence, be concluded, as a result of poverty and bunger, men's morale must lower to a

point at which vice, war, postlence, and other "natural controls" will provide the inevitable check.

Those who back this pusition hous hypothesis forget the depest roots of man's indomitable character. These roots are Courage and

Imagination.
But what are we doing

about it?

First of all, we have made a survey to the attuation. The figures on page 39 show us what to expect in the matter of population form the fact that already our census experts can predict to a fraction what the population of the United States will as 10 years from now.

Next, domes a survey of the world's resources, present as well as future, especially power and food

Arrhenius, the famous Ewedish acientist, has listed and has computed actual values for every source of energy open to us with our present prevent are velopment of acientific knowledge. They are Solar radiation, air cur-

trillionth of the sun's total heat ever can be put to human mage. And so on.

Food as we know it today is an equally definite matter. Take the grain supply, which is the most economical means of utilizing land. The land area of the earth



present rate of population increase, even with our present facilities for using the world's available resources of food and power, babies born today may live to see conditions of such intolerable overcrowding as to make existence but a ghastly

nightmare.

Science alone promises salvation. For actence, though slow, is indomitable and sure.

Science, despite its longrange guns and posson gas, is ever on the side of human welfare. The scientist, if the truth be known, is the most ardent pacifist of all. Witness research workers' tireless efforts to guard us from thissase, atorm, pain, fire, and fear of early death, to entertain, to enlighten, and safely to convey us where our children whims

What, then, is Science's promise of life in the overcrowded future?

First—possibly before the year 2000—a world of conurbations, (Con, together, plus urber, cities, literally, a number of cities joined.) New York, Pittsburgh, and Chicago,



A glimper of what science has in store for the crowded super-city of the future in furnished by John M. High, Jr., a young inventor of Riverdale, M. Y., abown above with the "wireless city" he has constructed to his laboratory. Incomdescent lamps and even toy motors natalted in ministure houses and factories are made in operate by radio-frequency currents treasmitted from a generator near by From his experiments he believes it will be possible for an entire community to receive its best. Eight and power by radio from a central station perhaps hisadreds of miles away

rents, evaporation, flowing water, storage

in plants, coal, and ou.

Arrhenius says that the total water power, or "white cost," in the world is 745,000,000 horsepower. He declares that England's cost mines will be exhausted in 200 years; that less than a ABOVE is a typical oldewalk scene in the New York City shopping district. Statisticians say that the population of New York will pass the £2 000,000 mark by 1933, and will reach 29 000 000 by the end of the century.

During the last century the population of line Electric States has doubled itself approximately every 30 years.

On the besin of U. II. Crosses figures of growth during the 30 years from 1890 to 1970, and excluding such factors as possible anneastions or detachments of territory the populations of other of our largest cities by the middle of the twentieth century thay he estimated conservatively as follows.

FIGURES BASED ON U. B. CENSUS

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		Pe	of Cortical	
			remor 1950	
Threships	099 830	3 01 -05	145 G.019 L	27
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Detroit	205 416	876 LOB	367 4 789 2	10
Tevel mod	261 353	T96.841	205 2 430 34	55
k Louis	451 770	772 897	70 1 321 6:	53
lor on	448 472	. 48 06P	67 1 249 20	80
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Terrimad k Louis lorton leitimaté	261 353 451 770 448 477 434 439	796,641 772 807 748 060 733 826	205 2 430 3 78 1 321 6 67 1 240 2 69 1 240 1	

"In extension the 1921 population of Detroit, the Censia Bureau says: "the growth from 1910 to 1920 if projected, gives a figure believed to be considerably in escess of the actual population"

(exclusive of the polar regions) is 35,000 milhon acres. If we could raise 23 hushels of food corn a year on every acre, the total yield would be but 752,400,million bushels

But we know that a fair figure for connumption is about 5.7 bushels a person annually. The answer is that if every available square inch of dry land were cultivated to the best of our present ability, the earth could support only 50,000,-000,000 people, or about 26 times the number we have now.

Today we are facing the grimmest realization man has ever met. This is it:

Humanity is in danger from itself. Not war, nor famine, nor disease; but occrepopulation.

Or, putting it another way: At the

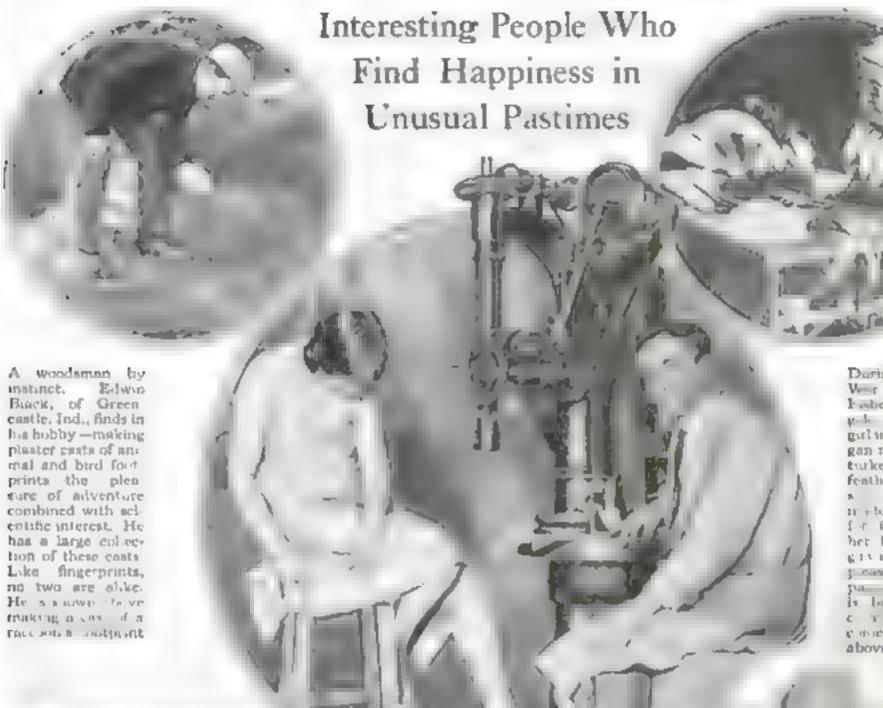


Congested motor traffic along Fifth Avenue, New York. In the last 10 years the number of motor vehicles in the United States has increased from 1 287 000 to 14 500 000 Will the next generation see super-nationalizes that will cost but a song and will never next repairing as well as radio-controlled fundates surplemen to easily the suburbanite to his place of business in the city?

with their innumerable suburbs, already are typical conurbations of a generation hence. It is not difficult to picture what the inner focus of such a population center will be like. Even today in our large cities, traffic is out of hand. It is evident that we must shift to streets in "decks" or "levels," subways, truckageways, motor-vehicle-ways, and on top a way for hordes of pedestrians.

(Continued on page 133)

Fun and Profit in Riding Hobbies



During the Civil Mery Pasher F San Angala Tag then a gul in her teens, began making fana of turkey and pencock feathers as a diver-It is years she medical me as gatter for free to. Now. her haddly besters gaving her n presentable occur pa an in de nece Is because her n e of table inabove at her work

Even an angent sost

County armor has bien transfer a co a a trieprie ly New York City, who has collected and may structed a remark To descriptional of the " immercas The Fac 6 1 4 10 10 10 10 designed on the metal breastplate of the armor, as shown in the pacture above

Until a few years as Norman La Plane, of San Francisco, Cauf., was a machinist by trade. Now that he has become a fullfledged sculptor, machinery is his postime. His workroom is a combination machine ship and at die

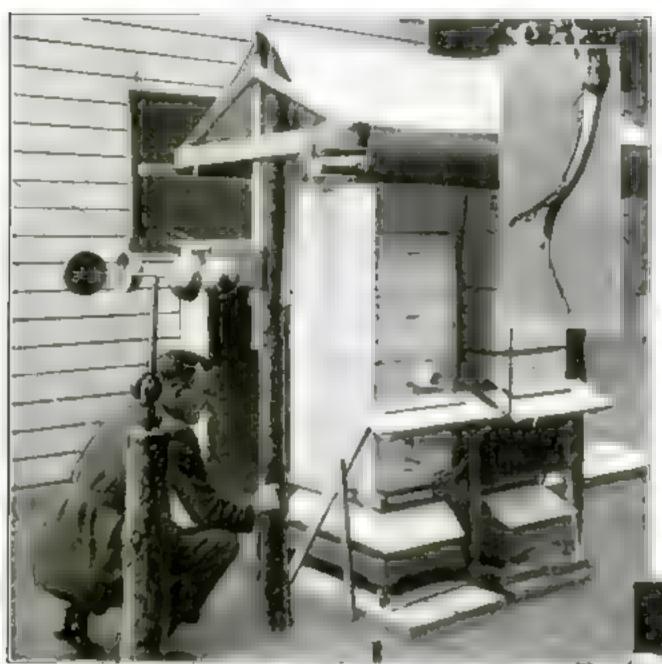
1 72 SF / WHEN

Built at the workbench of a ship's carpenter in 1000 spare hours and at a total expenditure of \$200, this model power ship, now on exhibition at the University of

Washington museum, is said to be one of the most perfect ship models ever built. The builder has incorporated every detail that is found in a full sized ship Interaction of Ola Me & Frame, Dr A . 1 Benna men Rice Cost print the driving 1 4. gnarled but agale forgoth Mark Mart Va At the spread to the firms or his nobby a sell aste of He shows also holding a toy motortrack constructed at his workbeach

A Time Clock on the Honey-Bee

Nature's Most Industrious and Orderly Workers Are Checked and "Fingerprinted" on Uncle Sam's Bee Farm



The strick of characteristic are sent to all Unite inside for any Westing of the Direct characteristics of the strict of the str

The test above the noney go is not expense as of the box oftent by a ray of Principal Principal Component as With the starting tool the bee extracts from

On worse the new age who ho age extrame a smaller mas have the On he are to the or a smaller at me from water to make a smaller at me from water to make a smaller at me from water to make a smaller at me from a smaller at me from a smaller at me from the me at me from the me at the new at me from the me at the new at

By George H. Dacy

NCLE SAM has become a bee-

At Washington, D. C., only a few muse from the White House, the United States Government has established a beefarm where, during every hour of the day and hight, the activities of 3,750,000 of the finest Italian been are watched and studied by a staff of experts.

No movement of the insects is left unobserved. By means of ingenious and extremely delicate apparatus the honeygatherers are checked and tabulated as accurately as though the observer were living in the hive—perhaps more accurately, for an electric thermometer is oblivious to stings, while wor betide the unfortunate investigator — human or otherwise—who would personally invade the privacy of the been home? fibis recent years to a

ernment is based on a desire to gather information concerning the possibilities of commercial development of bee-keeping in the United

States. Not only are the life and habits of Nature's most marvelous insect under careful observation, but experiments are being tried in the crossing of breeds, the relative advantages of various types of hive, the qualities of the different honey and similar data that, when gathered and given to the public, undoubtedly will supply a strong stimulus to the somewhat neglected art of apiculture.

Among the many devices that the government bee-experts employ in their study of the hives, none is more remarkable than the bee weather bureau. Outside the experimental hives has been erected a complete weather station in ministure — anemometers, becometers,

bydrometers, thermometers, and all the cities of ometers" that go to make up the weather man a armory. The reactions of the case to the alightest change in the case gical conditions thus can be conditionally the case be conditionally than the case of the case o

the "ruments have revealed that during the heat of the day—and Wash ngton can be very hot during the day' the bees are drowsy, that they freshen up with a coding breeze, that during cold weather they huddle in clusters for mutual warmth, responding to the range of the thermometer just as do human beings

ANOTHER strange fact brought out is that the bees are infall ble weather prophets. The approach of a storm will send the most avaricious honey-gatherer winging for home in a bullet-like flight, to remain in the warmth and dryness of the hive until the bad weather has paused Even though the coming temper by not be noted by human senses, the bees, through some mysterious foreknowledge, are warned in ample time to take

Immensely valuable figures on been producing conditions are being taxanited through this system. The been responses to various weather charges of a result of government experts to state with co-



A government becompart, protected by a veil, examining been at work is an experimental hims

fidence which breed of bees is the best for any climate.

THE work of the been is measured on a platform scale. The empty hive is placed on the platform and the scale balanced. A swarm of bees then is introduced and the weight read. After that the hive is weighed every day until it is full of honey. Since the number of bees in the original swarm is known, as is the daily gain in weight of the hive, the average daily honey-producing ability of a single bee is measured easily as the weight of the hive increases.

The work of the bees in the hive is observed by the introduction of magnify-

ing lenses in the sides of the structure, Electric lights are provided within the hive; the bees do not, apparently, object to this illumination. The lenses enable the observer to watch the bees at their work without disturbing them in the alightest.

BEES always have been known as wonder-working engineers. Their choice of the hexagonal cell and their construction of it is one of the mystories of nature. The hexagonal cell with a base of three equal, and similar paramograms is the most er monsteal cell that can be constructed with a given amount of material. What led the bees to choose it rather than the cylindrical shape, or the cube!

The most economical cell possible—the absolute in economy—has been found to have for its base argies 109 degrees 28 minutes, and 70 degrees 32 minutes. The mathematician König worked out these figures originally. When the angles at the base of the bees' cell were measured, it was found that they corresponded exactly to the figures of the human calculator! It would seem that the bees are by instinct as elever mathematicians as the most learned of men. And they build their combs in black darkness, a feat that the most skilled artisan among men might try vainly to match

The clustering of the bees to produce the wax, the careful chewing and moistening process that must go on before the wax is fit for use; the actual construction of the comb itself by the worker bees—all these mervelous processes are observed at first hand, as well as the storing of the honey, the laying of eggs by the queen, and the emergence from the cells of the newly born bees.

No industrial or commercial enterprise ever jaunched by man has approached the efficiency of the busy hive. Though bees live only about seven months, their short lives are crowded with effort and achievement. Each bee has its own place



A amole torch quiets the best as the laws is opened. Been believe in preparedness. Sentres By around the laws continually. At the approach of an invader the entire population responds materially in battle agency.

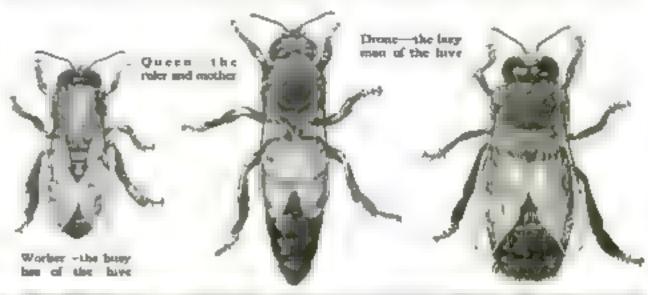
in life, and its life work is appointed at birth. Moreover, whether it be honeygatherer, sentinel, or comb-builder, the bee never attempts to change its occupation, nor to see belong its station. Greed, discontant, environment over-ambition are unknown in the five.

speak often of a "bee-line" to convey the meaning of the most direct course between two points. No bee-line that man might lay out, though, could be more direct than the path traversed by

be disturbed, the bees seeming to know that a visitor with honey cannot be intent on barm.

THE Washington observers have learned that the bee must rest after working. Having no eyelids, the bee cannot close its eyes in sleeping, but the worker bees are observed to retire to secluded rells in the comb at regular intervals, remaining there inactively for hours at a time.

A strange feature of life in the hive is a





Through glam windows in the elder of the hive as shows above, government eccentists are able to observe the work of the best day and night without disturbing them.

This is all the more remarkable since the bee does not steer its course by vision. The direct flight of the bird is understandable, since it readily picks up landmarks. The bee, though, cannot see for more than a few feet. Once it was believed that the bee guided itself by scent, but scientists know now that it does not smell its way back to the hive. They believe that its extraordinary acute sense of direction is due to its possession of an instinct unlike any possessed by man.

This homing instinct is one of the bee's strongest traits. If the hive is moved while the bee is out, upon returning it will dart immediately to the former location and wander about in a troubled way until it finds its home. If eggs are taken from one hive and hatched in another, the young bees will return to the original hive as soon as they are able to fly. There they will be welcomed, and welcomes ordinarily are not accorded to visiting bees.

If a strange bee visits a hive unladen, it will be attacked by the inhabitants. If it is carrying honey, though, it will not jazz dance that the bees stage avery now and then. All the inmates of the hive take part, awaying to and fro and going through weird contortions. Thus, the federal investigators have come to believe, is merely the beehlve system of communication. By their bodily motions the best are telling one another where the choicest honey nectar is to be found and possibly choice bits of current gossip.

THE bussing that comes from the been as they work in the hiven is not a song, nor is it made up of grunts denoting violent effort. It is the ventilation system of the hive at work. Bees apparently require fresh air as they labor, so they cause it to circulate by moving their wings in unison, bringing pure air in from the outside and driving the foul air out. The motion of the wings is responsible for the bussing.

Sometimes mice and other small animals get into the hives. The sentinel bees immediately set on them and sting them to death. Obviously the carcasses of these intruders are too large for the bees

(Continued on page 136,



Flowers of the semmon marigold, clealing for the night



The same flowers, with petals opened to the light of day

Plants, like Animals, Feel Pain

By Clifford H. Farr, Ph.D.

Assistant Professor of Botany, University of Iowa

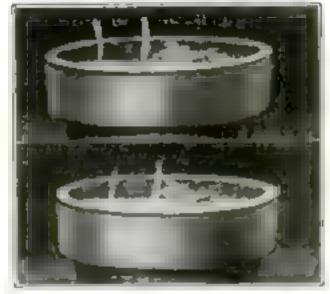
F YOU should see some one whip a horse or kick a dog, you would not question for a moment whether the animal felt the blow. But if you pluck a rose, peel a potato, or mow a lawn, you probably never stop to wonder whether the plants know that they have been touched, or whether they feel pain

And yet recent developments in the study of plants point unmistakably to the likelihood that plants have a mental life, a consciousness, closely resembling that of man and the animals; that they have senses that record impressions, nerves for the transmission of impulses, centers of association where the nerve messages are that respond to the messages.

In other words, plants apparently feel and see, suffer pain and experience other emotions. These conclusions have been reached by botanists as a result of observing the reaction of plants to various at mult the same process by which man has concluded that animals have believe and feelings and emotions.

The chief reason why man has been louthe to ascribe mental trace and feelings to plants lies apparently in the fact that most plants are so allow to respond to stimus. The so-called sensi-

tive plant, mimosa, is a striking exception. This plant will respond to a blow with amazing rapidity. If you strike the leaves of mamnes, the leaflets fold, and the leaf stock droops quickly evidence that the plant is highly sensitive. In the durkness the real stack is raised and the leaflets are folded. Introduce light auddenly and the leaflets unfold in a way that suggests that the experience is unpleasant Stroke the leaflets gently though, and they will fold again as if the caress is pleasing. Then, if you strike the leaf sharply, the leaf stalk droops as if suffering pain.



Young out needlings before top and after bottom being capoued to a light from the right for 11 seconds. Note how they brinds toward the light in this brief incavar

THE mimora actually a not more senting than other plants, but a special motor organ, called the 'publicus," at the base of each teach that and at the base of the main leaf stack toruses the plant to move in response to simula it receives. Plants are sensitive to virtually al. the samula to which managements and in

Plants are sensitive to virtually all the samula to which managesponds, and in some cases to even a greater degree. The roots of certain plants will curve in reasonate to an electric current that is 1 400 as powerful as the smallest current that man can feel. A pressure no

stronger than the failing weight of a hair will be felt by some plants and will result in motion

Plants respond to temperature, light, contact, abook, pressure, tension, gravity, electricity, wounding, gases, and liquids in fact, the only sense that plants are known to lack is bearing. The ancients believed that certain plants responded to thunder, but modern botanists believe that this is a result of the jarring effect of the concussion

If plants cannot see, it is difficult to explain the fact that the compass plants turn the flat surfaces of their leaves toward the sun at all times of day—toward the east in the morning, the west in the evening and straight up at noon. The surflower, too, turns to face the sun

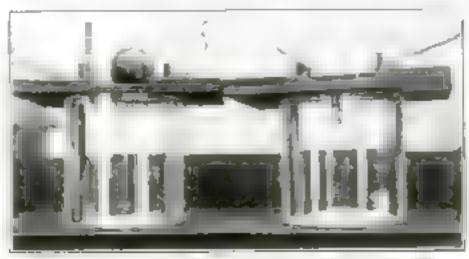
If you have been accustomed to work in the daytime, you would experience discomfort in suddenly engaging in night work. So it is with plants. The sorrel, for example, is almost obstinate when asked to change its habits. If this plant is placed in a room illuminated only at night, it takes it several days to learn to open and close its leaflets according to the new schedule of existence.

The mangold can be taught to open and close its leaves every at hours, nates of every 12 by subjecting it to art ficial light.

The colcophus, the covering or sheath that envelops the seedlings of cereal grains, has proved highly sensitive to

light. It even can add and subtract intervals of time in a way that is almost uncanny. Thus, if exposed to a weak light for a time shorter than that required for it to respond, it will show no reaction. But a several short exposures are given, the coleoph le will add them up, and, when the total reaches the smallest exposure that will affect it, it will respond

Sir J (Bose the noted Hindu plant physiologist, discovered recently that plant cells have a pumping action similar to the besting of the human heart. He has found that plants contract and tremble under shock and respond to drugs.



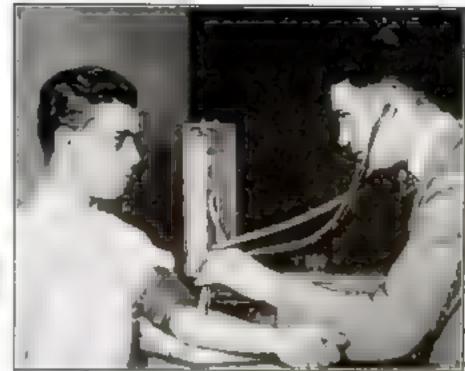
Shocking the roots of plants. An electric cutrent of 925 milliampers is passing from right to left through water in the jury. The roots of the lapane plant in the jur at the right respond by cutring toward the source of current but those of the onion at the left apparently are not updative to this intensity for they remain unmoved

"You Can Add 20 Years to Life"

Science, the Physical Auditor, Can Tell You Where to Find Them







Blood-pressure measurement is valuable in detection of disease

By James A. Tobey Administrative Secretary of the National Health Council

OW would you like to add 20 years to your life? This may sound like an indvertisement for a new kind of gland transplantation, but it is/not. At the present time the average length of life emong Americans is only 58 years, whereas it ought to be 78. Moreover, metical science knows exactly why those 20

find them and add them to your life. Only a few weeks ago Dr. Ray Lyman Wilbur, president of the American Medical Association and of Leland Stanford University, asserted at a medical convention at Des Motnes, Is., that if doctors were permitted to apply all they know to all the people, not only would life be prolonged and human happiness incressed, but the whole aspect and

years are mining and how you may

What he meant was that people continue to die young because they fall to make full use of the knowledge and skill that medical science posenses, particularly in the field of preventive medicine

order of life would be altered.

People get a good start in life these days. Doctors have learned to bring them into the world in safety and to guard them against the diseases of infancy that once destroyed vast numbers of bables. Medical inspection in schools protects them against the diseases of childhood. But, once they are out of school and on their own, the subject of their health becomes overshadowed in importance by other things in their manda.

I received a poetal card a few days ago from a friend of mine, a chemist, who for two years has been at Saranac Lake, N. Y., fighting tuberculosis. The message said be was cured and was preparing to start for home.

Naturally I was glad to receive that memage, and yet I can't help but feel that quite unnecessarily that man has let two years slip from his life. He used to be fond of motoring and was a trank about keeping his artishobile in sepair. The third body square, the emphest rattle of the notor would send him currying off to a service station to have his car looked over her stat same men paid not the allehtest attention to a cold that hung on

and on. At last he was forced to quit his job and go to the woods to struggle for .ife.

A prominent breeder of fancy cattle died last fall from heart trouble. He was only a little past 40. An acquaintance of his supplied me with a few illuminating sidelights on this man. Many, many times, his friend told me, he had gone without sleep to nurse a sick cow. His cattle were housed in the most modern barns and their lives were regulated by the

clock and scale. They were, in fact, better cared for than their owner; for he, suffering from a dangerous heart ailment for years, never had consulted a physician.

YET in spite of cases such as these, which probably are typical of the health carelessness of a majority of the population, modern medical acience has succeeded in removing many of the obstacles to longevity. Especially is this true in the control of communicable diseases, such as malaria, diphtheria, tuberculosis, scarlet fever, typhoid, and a

host of others.

Modern medicine is getting the best of them. Smallpox, which once was classed as a violent scourge, has pretty well subsided. Typhoid has almost disappeared, due to the activitres of sanitary engineers in cleaning up municipal water supplies. Diphtheris is on the wane, thunks to the use of antitoxin and the Schick test. So it is with many other germ dueases. Tuberculosis has been reduced 50 per cent since 1900, and yellow fever has been eliminated in North America.

It happens, however, that there is another class of diseases, which science cannot control by such methods as supplying people with pure water to drink, or by enminating germ carriers. Once these dueases have been permitted to develop, curing them is difficult and at times impossible. They are known as

HOW THE AVERAGE SPAN OF LIFE HAS INCREASED.









IN A little less than a century and a quarter scance has accreamed the average length of human life by more than 20 years. Since the exteenth century the life span has been more than doubled. And in the last quarter century alone more than 10 years have been added.

Yet even now the annual economic loss to the United States from preventable dueases and deaths is estimated at \$3,000 000. Every day 3,000,000 persons are sick in the most enlightened country in the world This means that of every hundred Americans, nearly three are sick each 24 hours.

Experts in life extension tell us that from our present scientific knowledge, it is theoretically possible to prevent 250,000 deaths a year. They tell us, too, that the normal person, by careful living, can add from 10 to 20 years to his life. To do thus, the first important step, they say, is a thorough physical examination by a competent physican at least once a year.

Will the year 1930 see the average number of our years increased to four score? Science says it can be done, and shows us how to do it. It is up to us.

organic, or degenerative diseases, not communicable. They arise within Individuals from physical reasons peculiar to

the victim.

Included in this class are cancer, heart trouble, apoplexy, Bright's disease, and other kidney affections. Others medical scientists call "diseases of metabousm," auch as diabetes, due to faulty chemical processes in the body. These are generally diseases of adult life after middle age.

R. HARVEY WILEY once said that it is better to die of cancer at 80 than of typhoid at 20. But modern medical science is rather of the opinion that it is better not to die of either, but of old age, which happens to be the rarest cause of

death today

The worst feature of these degenerative ducases is that they frequently develop before one suspects their existence. Experience has shown definitely that many persons living perfectly complacent lives actually are suffering from some incipient malady. They are entirely unaware that anything is wrong. Of more than 250 000 persons examined by the Life Extension Institute since 1914, according to Dr. E. L. Fisk, its medical director, psarly all were found to have physical impairments

The accret of preventing the encroachment of organic diseases iten in early diagnosis. In other words, get to it at the start before the harm is done. This is more or less a new idea in preventive medicine. The old-time doctor would look at a patient aghast if he should walk into his office and say, "Doc, I'm feeling fine, but I want you to look me over thornughty and tell me whether I am all right

In every respect."

The doctor probably would reply with come egitation, "If you're all right, what

are you here for?"

All that is changed nowadays. The modern physician considers it part of his

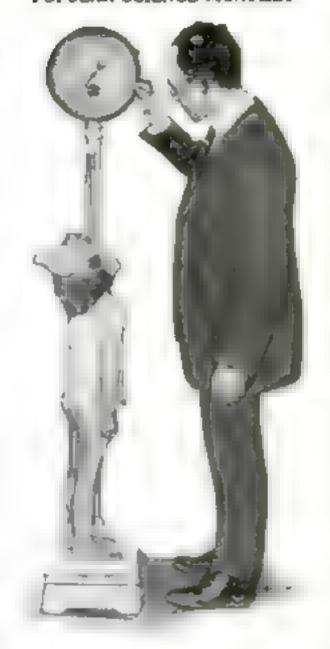
duty to keep his patient well.

Samuel M. Vauclain, president of the Baldwin Locomotive Works, bed the right idea when, as told fecestly in Popular Science Monthly, be arranged with his physician to keep him well or lose money by failing to do so. The think attorney is the one who keeps he dient out of court and out of trouble. The same

theory applies to a doctor. A good doctor is one who keeps his patient healthy and never has to

cure him

The first thing for any man who wants to add 20 years to his life is to start in a businessake way to take a human inventory. Have the human machine thoroughly inspected by a competent physician. Most intelligent persons now have the laudable babit of going every six months or so to the dentist whether they think anything is wrong with their teeth or not. The same practice can be applied profitably for the rest of the body. Physical inspection at least once a year will save doctor's



Periodic physical examinations of young children as well as suspection in schools have been important factors in the sucreta of medical science in reducing mortality during the earliest and most dangerou years of life. In three decades at least, years have been added to the prompt of life for children under five years of age

bills. Expose your defects and dambinities while they are strilly out and more or less impocuous, and so wast off possible future autering trouble, and even an early death this is prevention with a vengence

knew a legislator who took great his physical condition and pride it Moasted that he never had to go to a He worked unusually hard, attended many hanquets, took practically no exercise and was afflicted with numer-DUS WOFFIEL

One afternoon he saw an acquaintance at the top of a long flight of granite stairs in front of a public building. He particularly wanted to speak to this man on an important matter, so he rushed up the steps. When nearly at the top, he suddenly collapsed, and when bystanders reached him he was past assistance. The death certificate indicated as the cause, "acute cardiac dilatation," which translated into plain English, means beart dis-

This man had been living a placid life in ignorance of his dangerous malady. A physical examination would have revealed. his condition and he would have been informed of the danger in such sudden

exertion as running up steps.

I might go on and tall, perhaps, of the women who ecorned the lump on the breast, refusing to consult a competent physician, until finally a malignant cancer developed and the entire breast had to be removed to save her life. When you know that death is near, then is the time you usually want to fight to get back what you may have squandered. But the time to begin healthful living and practising the rules of hygiene is right now, not after you have had a physical breakdown.

IF ANY one wants proof that a periodic medical examination will add years of life, the most convincing evidence is right at hand. For a number of years a large life maurance company has offered to its policy holders free annual physical examinations. A study of the first 6000 persons Examined in 1914 and 1915, revealed that only about half as many of these persome had died an should have died by every mathematical calculation based on long Pears of actuarial experience.

Whrean, by scientific computation, 412 of the 6000 individuals should have died, actually only 217 succumped in five years. The officials of the company figured that by offering free physical examinations thay had made, on a conservative estimute, at least 200 per cent on their in-

vestment.

If it is worth that much to a life insurance company to give its policy holders medical examinations, it is worth it to

you to have one

if every one in the United States would acquire the personal audit habit and have his physical assats checked up at least once a year, then eradicate any defects or ailments revealed by the audit, there is no question whatever that 20 years could be added to the average span of life.

Of course, merely getting an examination isn't the whole story. It is the follow up that counts. I may know that it is wrong to let a man anseze in my face, but if I let him sneem in my face, that is not safe living on my part. Here, then, m the hygienic recipe: Have a periodic human stocktaking.



Carrying the benefits of arientific health impolodge to out-of the way places. A traveling clinic visits rural districts, giving free emeninations for children

Useful New Products from Rubber

Shipments of Milky Sap from Plantations May Revolutionize Industry

By Ismar Ginsberg, B.Sc.

TEW methods in rubber manufacture and the employment of rubber for many unusual uses are predicted as a result of the recent introduction on the market of rubber latex, the mak-like gap of the rubber tree.

This product is not new in the strict sense of the word, for it is the source of rubber as we have known it for many years. But never before has the later been shipped. Whether gathered in the Ceylon plantations or in the jungles of South America, it always has been changed into crude rubber before shipment, by smoking over a fire of rubber leaves or by means of chemicals.

Now, though, the later can be carried to the United States and elsewhere in tank steamships, as oil is, and transported to manufacturers in tank cars or drums. Thus, if they wish, manufacturers can utilize the later in its original state in the manufacture of standard rubber articles without changing it into crude rubber

The elimination of the crude rubber stage in the process of manufacture, of course, is of commercial importance. Even more important, though, is the possibility of using rubber in the manufacture of products in which rubber never before has been used. This is due to the fact that the latex can be handled almost as easily as water.

RUBBER later is a milky fluid containing about one-third rubber. The rest
is water and various resums it is neserved with ammonic for shipment but,
on exposure to air the ammonic evaporates, and evertually the later becomes a
gummy mass. The later can be mixed
with almost any substance and u can be
handled in such a way that the coagulation can be regulated to fit necessity.
This is what makes it such a valuable
product; for, after the rubber is coagulated, it holds together the fine particles
of the mixture in a firm union, and the

whole can be vulcanized and converted into a hard, strong mass in which the binder is solid rubber.

The advantage of using rubbar latez is demonstrated, experts say, in the tire industry. Better impregnation of the tire fabric is obtained by dipping it into the later, they declare, than by compressing the fabric and grade rubber between rollers or saturating the fabric with a solution of crude rubber Waterproof Jabrics of all kinds are said to be improved and manufactured at less cost by using the liquid product.

In the fields of industry where rubber never



A native of Businers gethering lotes, the milk-like rubber cap, for shapmark

before has been used, the new product has aroused the greatest interest. For example, until now there has been no putty that will hold a window-pane in place permanently. When putty is dry, it always falls out of the frame. But a not window-pane and you are likelysto dislodge both the putty and the man. But a putty made from rubber jane and a suitable pigment to siller is and to last as long in the pane it holds. That is because subber obviously is more lasting than largeed oil, which, with a titler, now composes putty

Similarly, in the manufacture of linoleum and offcloth, subber later offers an improved substitute for inseed oil, requiring no extensive changes in the details of manufacture. In the manufacture of a waterproof cement, or paint, to seal against moisture cellar walls, floors, or similar porous structures, the possibilities of rubber latex are apparent. Already it has been used experimentally in making cements. This process is simple, requiring only that rubber latex be mixed with the desired adhesive.

Rubber cement is ready for use at any time, does not have to be heated, and is absolutely waterproof. Besides lending itself to such uses as the repair of automobile tires, it can be employed even to join glass and metal. Likewise it has proved a satisfactory binding agent for such woods as ebony that usually must be treated with chemicals before they can be glued. Glass, mics, paper, leather, and textiles of many sorts can be glued firmly by cements made with rubber latex.

EVEN when mixed with such substances as waterglass or give solutions to produce cheaper coments, rubber latex produces a waterproof joint, provided, of course, that it is not diluted too much. These cheaper coments can be used in the manufacture of furniture for joining wood and glass, wood and brass and fastening brushes into wooden and metallic handles, in the manufacture of furniture—for virtually every purpose, in short, for which gluss are used.

Hemp moistened with rubber later can be used in making pipe joints. Gives made with rubber later are said to be especially adaptable to the manufacture of violine and similar stringed musical instruments. In violine it is said to produce tones that compare favorably with those of the instruments made by old Italian masters.

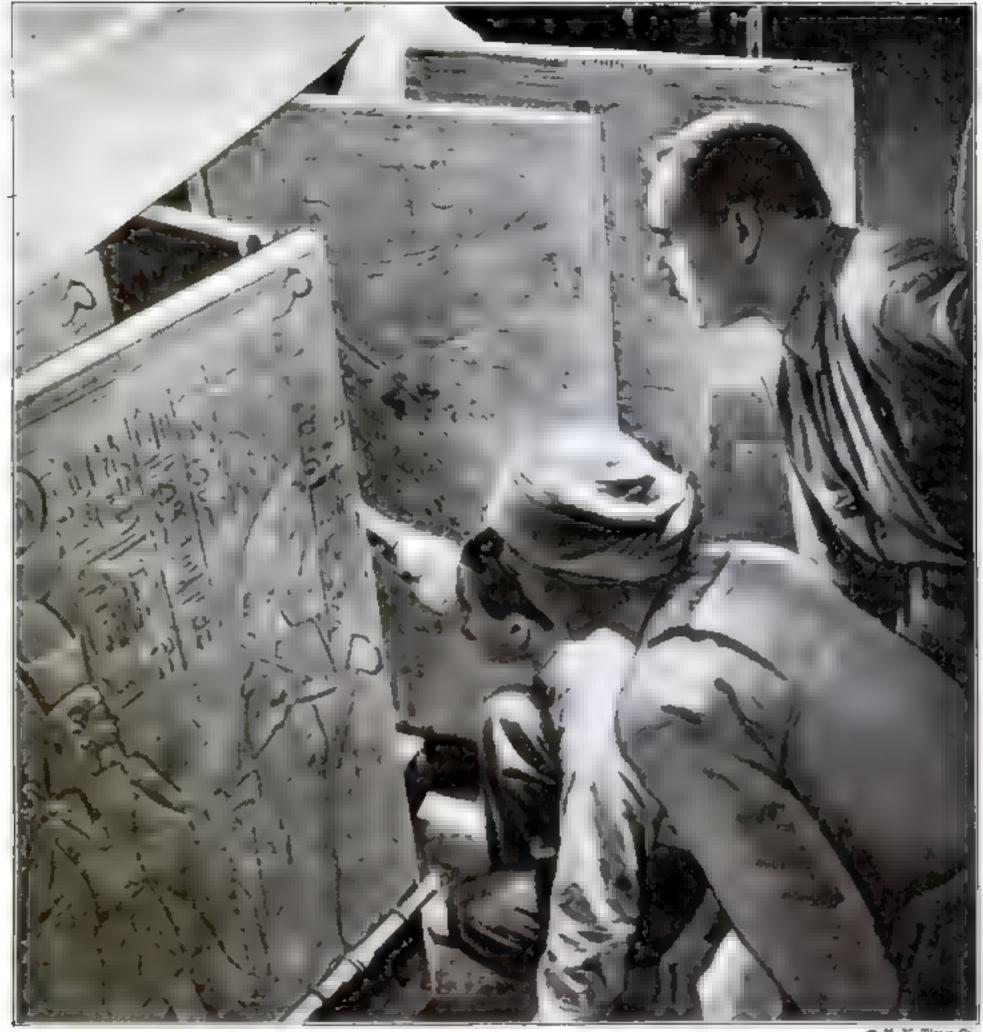
Finally, for the rubber industry in general, the shipping of latex from the plantations makes possible the manufacture of crude rubber by new scientific methods rather than by the primitive processes used by the natives. Thus,

instead of men stirring the latex by paddles, it now flows on a whirling horizontal disk, which sprays the fluid in a mush-room-shaped mist into a heated surrent of air. Drops of rubber fall into a container where a white, spongy mass is formed.

Crude rubber made by this process is said to be of uniform quality, especially useful for the manufacture of tires, tubes, rubber soles and heels and similar rubber goods. Crude rubber has been produced successfully by this process in a factory near New York and the general adoption of the process is expected to lead to results little short of revolutionary.



Two of the new tenters that carry Sumetra later to the wherees in the Dutch East Indian, where it is loaded on occan freighters.



Where Science Found Egypt's Treasure

the discovery and excavation of the treasure-laden tomb of Tutankhamen, king of the eighteenth Egyptian dynasty, 8200 years ago-in pictured in the remarkable photograph shove

Howard Canter, American Equation-gist, who in Depender, 1922, found the ancient vault in the Valley of the Kings, is shown kneeling on the dusty rock floor of the burial chamber opening the last instant was revealed the priceless goal of a ten-year search—the great golden-pink granite sarcophagus that has held the mummified remains of the great king

Since Carter and Lord Carnaryon,

half ago, dramatic events have followed in quick succession. Tragedy, to, in the paysterious death of Lord Carnervon.

TUTALKNAMEN's tomb proved to be the richest find it history. Its outer chambers gave up riches beyond price—gold, precious jewels allabaste. And, beyond all, angient inscriptions and decorations that are rewriting history

Proceeding slowly, Carter and his men recently reached the gilded outer shribe that almost filled the sepulchrai chamber. Within were three other shrines, like a nest of boxes, covering the sarcophagus. Here were found the royal throne

HE dramatic climax of the greatest leader of the expedition, first entered the covered with heaten gold, the royal mace, archeological romance in history— antechamber of the tomb a year and a alabaster vascs, perfumes, and the ebony sheds of the king and queen, inlaid with precious stones

On the doors of the fourth and last protecting wings outstretched, indicating that within lay the coffin of the king.

A HEW days later, Carter, umng in-tricate tackle, lifted the sarcophagus lid. Two lines shrouds were rolled back, revealing a huge golden mummy case, its top fashioned in a strikingly lifelike semblance of the dead king, one hand holding a crooked scepter of gold.

The Egyptian government now has assumed control of the treasure-filled tomb.

Power in the Volcano's Hot Breath

OLCANOES, which since earliest times have been a symbol of disaster and terror, today are known to accentists and engineers as a source of productive use to man in exactly the same way as are the waterfalls, coal-mines, and olifields. Science has learned that volcanoes may be tamed and harnessed to work patiently and steadily in the production of power to turn the wheels of industry and to supply man with light and heat for his home and work.

A striking instance of the application of this new knowledge is furnished in South America, where engineers are preparing to subjugate the great volcano Tatio, member of the mountain chain known as the Cordillers Sililica, between Chile and Bolivia, by methods that might be compared with those used in prosecuting a water-power development or any other great industrial project.

They plan to convert into electric power the energy developed by the boiling laxes of leve in Tetio's highly depths and to utilize it to confuer the mountains by electric alloways and so to promote the industrial and commercial development of Chaptend Robyls.

A coul shorings that left these two countries in a desperate plight was the direct cause of the project to barness. Take A geological party, seeking oil along the Chilean-Holivian frontier to supplant the dwindling coal supply, noticed a huge cloud that clung to the side of the slumbering volcano. Investigating, the scientists discovered that the phenomenon was caused by great clouds

By William J. White, Jr.

of steam puffing through cracks is the mountain sides.

The geologists took no action at the time. But not long ago, word reached South America that an electric plant in Italy was being run successfully by volcanic steam and the engineers who were responsible were invited to visit Tatio.

The visitors were amazed. With the proper machinery, they asserted, the steam emazeting from Tatio's slopes could be converted into electric energy totaling 400,000,000 kilowatt hours a year—the equivalent of almost a half militan tons of coal! The steam was found to be virtually free from impurities, which would permit it to be run don'tly into turbines without the necessity of installing expensive and complicated cleaning apparatus.

HIVE the darnesing of Takio has not progressed beyond the planning stage, a company has been organized to carry on the project. Electric railways one of which already has been established from Santiago to Valparamo in this, are the most likely possible consumers of electric power. Then there are the sliver and copper mines in southeast Bobyia and northeast Chile.

South American engineers say that the construction of a volcano-driven electric plant on Tatio's sides undoubtedly will result in immediate commercial development of both countries.

As a demonstration of the immediate practical commercial utility of harnessing

volcanic power, the achievement of engineers in the <u>Yoltarra</u> region, in Italy—about 50 miles south-southwest of Florence—is most significant. From the generators, electric power is being carried half a hundred miles and more into Florence, Leghorn, Sienna, and Plombino.

THE Volters region contains about 21 square miles of volcanic land in which steam jets and hot-water springs abound. Iron-incased bore-holes, from 200 to 500 feet deep and 18 inches in diameter, have been made here at advantageous locations, and from them the natural steam issues at high pressure and at a temperature ranging from 200 to almost 400 degrees. Fahrenheit. The stam is paped to suitable turbines, connected directly with electric generators.

Bending the volcano to the needs of industry marks a tremendous step forward in man's struggle to tame the forces of nature. And yet, in the opinion of leading engineers, the future holds a much more thrilling prospect. Some day, they believe, man will make his own volcanoce by boring miles into the ground to extract and uture the heat of the earth's interior.

Sir Charles Parsons, responsible for the steam turbine, already has estimated that a shaft sunk 12 miles into the earth's crust would tap the earth's store of internal host. Some day it must be tried. For the ever-increasing demands that are being made on the earth's coal and oil eventually will lead to their exhaustion, and, when these courses of power fail, what substitute more logical than the millions of horsepower that slumber under earth's rocky great?



A spectagular nighttime photograph of a voicane's cretor, where belling fave and steam held tremendeus steres of unused power

Pathfinders in Science

A Close-Up of Mars-Thought by Radio-The Sky-New Discoveries

YN AUGUST of this year, we shall be within 35,000,000 miles of Mars merely a three-minute hop for a radio

or light wave.

Scientists who know more about the geography of this neighboring planet than was known about the surface of the earth only a few hundred years ago, will be on the lookout for new facts when the visitor comes closest this summer. Particular

efforts will be made to ascertain, if possible, whether there is life on Mars.

If Martiann exist, scientists say that they probably are not like us. Astronomical study bas shows that conditions on the neighboring planet are not like conditions on earth; hence, not of a sort to support the life we know. That does not mean, though, that Mars eannot support any kind of life, any more than the fact that man cannot live at the bottom of the orean proves that there cannot be fish.

If there are intelligent beings on Mars, no matter what their size and shape, scientists of the earth some day will learn how to communicate with them by exchanging some cort of signals.

Once the inhabitants of either planet are certain that the other also is inhabited, some sort of an interplanetary code may be developed, and

an exchange of ideas and opinions may be possible. The Martiana even may tell us how to conserve the energy of the sun.

A suggestion like thus, counting from a present-day scientist, is bearrely more fanciful than would have been the suggestion a hundred search ago that menonopposite sides of the earth some day might communicate with one another by radio.

Can Thought Ba Wirelessed?

RADIC yes used recently by three to transmit thought. Prof. Robert H Gault of Northwestern University, Prof. Gardner Murphy of Columbia University, and Prof. H. B. English of Antioch College, who conducted the experiment, asked radio listeners to concentrate and try to interpret unapoken thoughts.

They reported answers received from listeners who took the test indicated that thought had been transmitted hundreds of miles without the aid of words or code.

The transmission of thought would seem to be the next big forward step in metapsychosis. It may even prove to be the means of communication with Mars.

A New Blue Sky Theory

DROFESSOR VEGARD, of the University of Christiania, Norway, has advanced a new theory to account for the blueness of the sky. Just outside of the earth's atmosphere, he says, is a wall of crystalline particles of nitrogen, incasing the earth in the same manner that a fabric envelope incases a balloon or a dirigible.

Uses Parasites in War on Grasshoppers

N A Cobb agricultural technologist of the Bureau of Plant Industry Department. of Agriculture has made remarkable progress in recent months, a offers to free the American farmer from the revages of the emisshopper one of per most demaging of agricultural peris. In numerous laboratory treats he has avoid that a cortain paraste called mermithed is one of the readlest enemies of the insect pest. Artificially infested grasshoppers continued as or right me muthals die in about eight days he reports while it is doubtful if presshoppers perbonne more than one of the paraster even material material. The paraster multiply with imaging rapidity

> Bradles giving the any its blue color then particles acround for several other homomena, he says, including he inct that radio waves follow the contour of the arth instead of flying from it at a tangent

Directed Radio for 2200 Miles

GUGLIELMO MARCONI at present is experimenting on directed radio communication over a distance of \$000 miles, from England to South America. Already he has made successful tests in sending messages from Cape Verde to Cornwall, a distance of 2200 miles. These experiments are being made to perfect his method of transmission by which energy is concentrated in one direction. Thus, for instance, he predicts that before long messages can be sent from England to Canada without fear of eavesdroppers

Novel Methods of Propulsion

AMAZING new methods of propelling vehicles over land and through the air have been reported from Europe within the last few weeks. M. Melat, a French inventor, is said to have developed

an airplane that lacks a propeller and a conventional motor, yet is capable of a speed of 400 miles an hour

This machine is literally hurled along in flight by explosions. Air and compressed gas are exploded in a combustion chamber and permitted to escape through a series of valves. The contact of the escaping gases with the air pushes the machine shead. This method is similar

to the one by which Prof. R H, Goddard, of Clark University, hopes to send his rocket to the moon, as described in the April mene of Popular SCIENCE MONTHLY

Another French inventor, M. Imbert, has evolved an automobile run by charcoal gas. This gas is produced in a furnace carried in the rear of the cur, and is fed into an ordinary gasoline motor. Testa are said to have been entirely nuccessful

Meanwhile Fausto Zarlatti, an Italian engineer, has aroused the interest of railway officials in his country with his achema for driving locomotives by compressed air. The compremor is carried on the tender, and is operated by low grade fuel oil. The compressed air is piped to the boller, then pumped into the cylinders. This scheme, it is said, would effect a tromendous saving.

A Remedy for Blood Poison

DR. HUGH YOUNG, director of the James Buchanan Brady Institute at Johns Hopkins University, recently announced the development of a remedy for blood poisoning, said to have proved successful in the treatment of several patients who were at the point of death. The treatment, which was developed by Doctor Young and Miss Justine Hill, involves the injection into the veins of a preparation known as mercurochrome-220, composed of mercury and a dye prod uct, or of gentian violet, a well known dye.

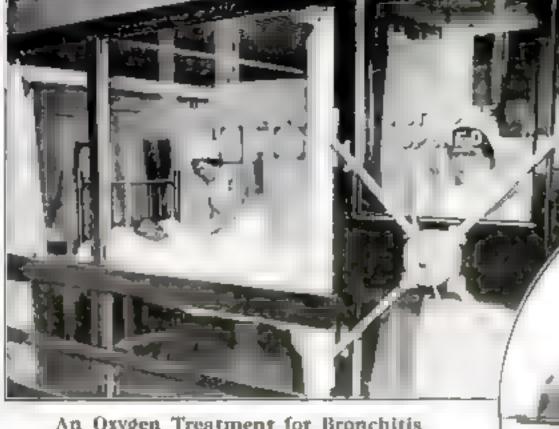
Immediately after treatment the body of the patient assumes the color of the dye; then his rapid recovery begins.

The Ma Jong Itch

IF YOU play ma jong, you may be exposed to the newest disease "ma jong itch." It resembles ivy poisoning, and is contracted, physicians say, from touching the bones and trays, finished with a lacquer, in which is a highly possonous extract of a plant called Rhus rerain

Eggs 48 Million Years Old

Prof. H. W Nachola, assistant curator of geology at the Field Museum, Chicago, is shown below exhibiting fossil eggs believed to be 40,000,000 years old, found in the "bad lands" of South Dakota and recently received by the museum. They have been identified as eggs laid by a prehistoric bard samular to the duck, and are believed to be among the oldest traces of animal life yet found.

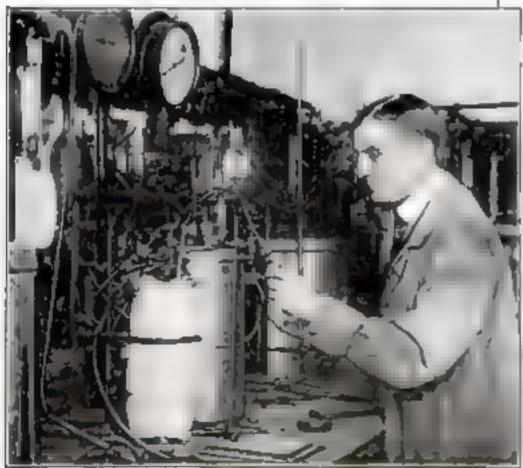


An Oxygen Treatment for Bronchitis

To test the life saving and pain-relieving powers of asyeen in the treatment of respiratory diseases, partializarly bronchitis experiments with a hermetically septed alives be get in con-turning layers arguing a inducted in Cas a Horsely, Londone England. In this sep of soom put this are kert for five oxygen or a while the authout present in ordinary air

The put ents are reported)to have experienced rehel from the nature unit parallel stages of their illness, and to have shown this revenue of several toys after the treatment

The oxygen as known shown above is the invention of Dr. R. P. Pour ton London physician. At the right a nutse is seen fattening the good abl door on entering



New Explosive and Fertilizer Found

Chesper ammonia, chesper nitrogen fertilizer, and therefore cheaper food are promised in the announcement of the discovery of a new chemical process for permanently uniting hydrogen and natrogen atoms in the air to yield 14 per cent ammonia. The new process was perfected at the Fixed Nitrogen Research Laboratory of the United States Department of Agriculture, Washington, D. C., under the direction of Dr. Alfred T. Larson.

He is shown above in his laboratory experimenting with the new uniting chemical, or "cutalyst," composed of iron ond, gluminum end, and potaggum and.

Not only will the discovery supply much needed cheap fertilizer for American farms, it is said, but it will supply the United States government with an explosive twice as effective as that discovered by the Germans just before the world war.



Measures Heat of the Distant Stars

Accurate measurement of the heat of the most distant stars in the heavens has been achieved by Dr. W. W. Cohlentz, of the United States Bureau of Standards, who is shown above with the measuring instrument he has perfected. This instrument is so delicate that it is responsive to the heat of a candle 50 miles away. It transforms the heat of starlight into electric current measured in 10 billionths of an ampere. Star heat was found to wary from 3000 to 10,000 degrees.



Music Shops Adopt "Noiseless" Phonographs

ALTHOUGH designed prescriby to end confusion of sound in phonographtalking machine may be useful assem apartment houses. Week it, one can listen to a record without a sound being

hear by any one else who happens to be in the room.

A wire cord loads from a small box at the base of the reproducing arm to an earphone, which is said to reproduce the sounds clearly and accurately,

Automatic Lubrication for Engine Cylinders

O MEET the need for adequate lubrication of auto engine sylinders an automatic device that gives the chamhere a steady, fresh suppry of oil has been invented.

A reservoir, mounted of the dash the hond, supplies the oil through surpose to a central insert in the intake marriald, between the call arcter and the ergine. The pumping article of the ergine introduces the oil, the quantity increasing as the speer of the motor increases

The off enters the combustion chamber. life vaporeds condition, bathing cylinder end intake atroke The maximum middet to the line of the reg lifted by adjulyment of a valve



The oil reservate, with adjusting valve



Revolving Wood Trimmer Operated by Hand

HE swiftly revolving blade of this new hand trimmer will not crush nor tear the toughest wood, is as on med, but will leave a perfectly staught and smooth

The total cutting edge ut 1617 rches, and any angle up to to degrees may be cut by action made, or the machine. The 40, 00-, and 90-degree angles are marked on the base to aid the workman and to expedige this setting.

The circular blade in used to produce a shearing cut, and is revolved by pulling a hand lever, which acts on the blade through gearing.

Glue Made from Garlic

NEW raw material to the manu-A NEW raw material by the manu-facture of a strong adhesive is re-ported to have been discounted in garlic, which when subjected to a boiling and pruning process ridges a strong of aroug binding power.

Pneumatic Auto Wheel Absorbs Road Shocks

ONGER tire life, greater buoyancy, and greater carrying capacity are claimed for a remarkable preumatic auto-mobile wheel developed on England. These advantages are empodied in a "double tire" arrangement by which an over-sized inner tube is permitted to extend into a chambel on the under side of the ram This feature makes it possible to use a nure-inch it will als with a S winch

outer <u>edges</u> designification accommodate the head of matandard cover. Between. three. outer edges and flat central portion next to the hub the halves form a second tube apace with a volume considerably greater than that



The proumatic wheel, showing inner air chamber

found in the ordinary inner tube. Six amail sleeves are vulcanized in the inner tubes at six equidistant points. Through these pass the holts that hold the halves of the wheel together. The beives are separated by a bit more than an inch.

The greatly increased air capacity obviously augments the shock absorption of the wheel. The enormous air capacity of the tire permits use of an inner tube with walls so thick as greatly to reduce the risk of punctures and blowouts.

Sanitary Wash-Basin for All Hands

COMPACT and sanitary (wash basin, designed to accommendate hree or four party is at one time, is the available of Louis Schlesinger, of Milwankle, Wis. The stater is delivered in a radiating shower from)a trasfal fourtain, upon the top of whitely is a liquid soat contained with fruit dutlets.



Three west up at the fountain busin.

New Plumb-Bob Designed for Quick Adjustment

ORE useful in many ways than the ordinary plumb-bob is a new instrument that permits instantal eous adjustment of the length of the cord by which it is suspended. This adjustment is accomplished by singht turn of a miled can repeated or tightening a clamp that hours also cord. Then the clamp is received a reel and springs within unwill or lift the bob.

h hyabies lines cord suspends the de-



The new plumb bob. showing edjustment cap-

obviating the annoyance of broken, tangled, or knotted cords. A hole in the hard steel point permits its easy removal for protection when not in use

The bob is designed partleularly for use in surveying work that requires many set-ups. These consumes great

deal of the surveyor's time when the usual long adjustments are required. In any sort of construction work, too, the new device is said to be a valuable saver of time.

One-Foot Control for Ford Brake and Clutch

A ONE-LEGGED man can drive a Ford car as well as his two-legged brother, it is claimed, with a new clutch control attached to the brake period. It consists of a curved pieces of metal that presses against the clutch legal when the brake is applied. Thuse the crutch is placed in neutral whenever the driver wishes to step.

The investion will be welcomed by all Ford drivers, for it frequently happens the wirver presses his clutch pedal too (a), thus throwing the clutch in low at the same time that he applies the brakes. The result, very naturally, is excessive wear on the brake bands.



Control has attackment for bruke pedal



The World's Smallest Observation Balloon

ONLY 16 feet long, the world's emissive observation before a bad hatually to carry an abserver about in perfect safety and to a considerable altitude. It is shown above dwarfed by comparison

with in ordinar army air service dirig-

vention of A Roy Knabershue, of Los Angeles, the man shown in civilian clothes.



Standing Crops Measured by Auto Meters

USING automobiles equipped with a specially designed meter upon which is automatically registered the six of cross standing in fields passed the United States Board of Grop Ecomates hopes to obtain prester accuracy than ever before in cross separts.

The defree is really a combination of 13 appelorators in and. There is a meter for will crop, such as wheat, corn, onts, cotton and hay. The instrument is operated from the speedometer gearing of the car. There are 12 crop meters and a speedometer that registers the total mileage.

Each crop meter, controlled by a button plugged in by the operator, records in linear feet the measurement of the field being passed.

At the beginning of a wheat field, for example, the wheat button is thrown in. At the next field, another button is thrown in, causing the wheat meter to stop regintering.

The totals for all fields should check with the total speedometer mileage.

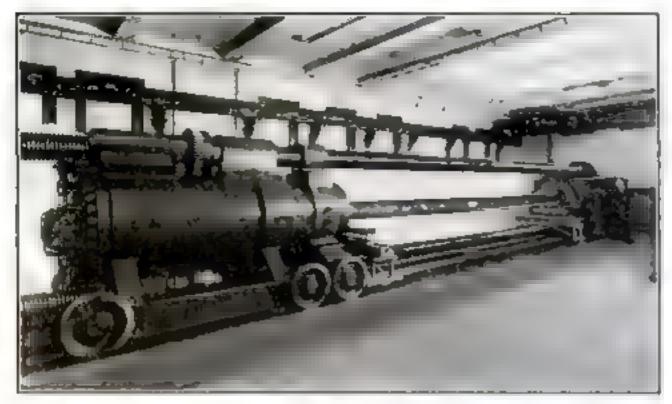
Removable Window Sashes to Lighten Housework

OPENING the windows for ventilation without creating unhealthful drafts and without permitting rain to enter, is said to have become possible by means of newly invented removable window suches. Both suches put only slick up the down that such executives and the top.

guickly and with little fort, the work of warming windows is made safer and easier. The feature also makes it possible to convert a bedroom virtually into a sleeping-porch, with a minimum of trouble to the occupant.



Removing the cash to wash the window



Move Two-Million-Pound Testing Machine

MOVING this 2,800.000-pound machine a quarter of a mile subfrequire about three months' work by the United States Bureau of Standards at Washington, D. C.

The machine, one for testing tructions

Machine Embosses without Heat, Glue, 🛊 Iph

EFFECTIVE emboding can be accomplished by any person, it is claimed, with this recently patented plachine, which requires to heat, ink, or glue and is said to have no complicated parts.

Loose type is alreed upon the type bars

Loose type is blaced upon the type bars and a piece of caruboard, together with a specially prepared paper, is inserted. A loog lever is pushed down, accomplishing the embossing. By using colored paper, oblored printing will appear embossed on the card,

A 5000-Mile Stage Line

JOURNEYING from coast to coast by motor stage soon may be possible if plans for a 5000-mile stage line from New York City to Los Angeles, Calif., and up the Pacific Coast to Portland, Ore., are carried to completion. The trip, lasting 25 nights and 26 days, would be made in suxurious touring coaches carrying eight passengers beside the driver.

The cost of the trip, exclusive of meals and lodging en route, would be \$175.

bersome a the world. It will be taken precently from the basement of the West Building to the best building, a half dozen min doing the work.

The large front is linder of the machine,

The large front a linder of the machine, weighted 22 tons, presents the most impressive task. It will have to be elevated tediously to a height sufficient to place it upon an especially constructed trailer, hauled by a powerful truck

IN AN unaucrossful attempt to solidify helium, Prof. Kamerlingh Onnes, of the University of Leyden, Holland, attained the nearest recorded approach to the absolute aero—about 458° F below zero.

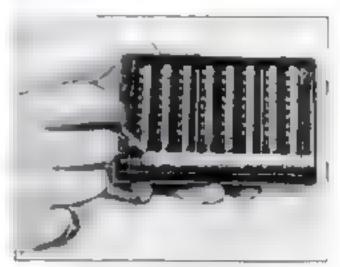
A Pocket Adding Machine for Quick Accounting

A POCKET accounting machine of recent invention can be used, it is claimed, to add, subtract, or multiply.

The device holds eight columns of numbers from 1 to 9. Opposite teab column is a movable metal band that runs continuously over rollers. Each band has perforations that fall opposite the numbers in the columns.

Addition is attemptished by inserting a wooden pointer or pencil in the band perforation opposite the testred number, and pulling, the band downward until the pointerfrenches the bottom of the column, addition of two numbers in this manner causes agree signal to appear in the totals lowest the bottom. When this signal is pulled down, the total is registered automatically.

Since the machine has night columns, its capacity is \$999,999.99.



Adding with the new pecket machine

Woman Operates Mammoth Filtration Plant

ONE young woman, at an electric control board recently operated for several hours a new \$3,000,000 filtration

plant constructed to supply 48,000,000 galians of pure water daily to Sacra mento, Cali I is a med that she, or

any other one persent could operate
the plant continuously unassisted so
simplified are the
controls of the
plant's extensive
mechanism

Man Alther Farrise, of bacraments, is the young woroan who operated the plant following its dedication by President Coolings who set its machinery abum by touching a button 3000 miles awa.



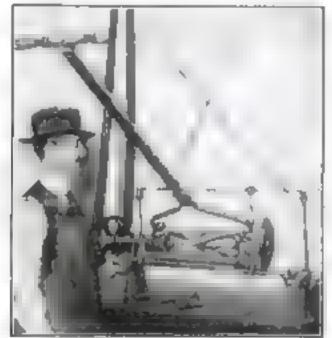
Above The operating flow from the Sarramen's Carl waver to be tem the wag electric the best Sarrament of the Sarrament of the Sarramento trenggrapher at the control board.



Viectric Motor Sharpens Lawnmowers Quickly

NY make of lawnmower can be A sharpened quickly and thoroughly, it is claumed, in a simple new mechanical sharpener driven by a one-quarter-housepower electric motor. It is necessary only to remove one wheel of the mower and to fit in its place a short puriey which turns the hades while they are being апагрения

The manner in which the blades and outter narrars sharpened together might be likened to the method employed in anding in valves in a gasoline engine. Powdered emery dust or carborandum is placed on a piece of thin cardboard about



A motor revolves the lawsmower blades

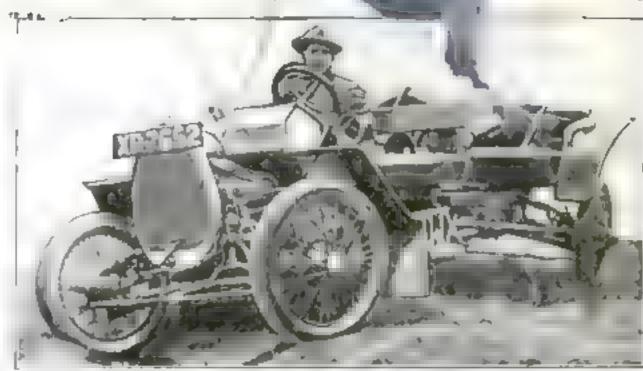
10 Inches wide and a pasta is formed by the use of a little machine oil

The revolving bludes are allowed to draw in the compound by passing the cardboard from left to right. This compound on the cutter blades as they meet the cutter har serves to charpen both at the same time.

This process makes it unnecessary to remove the roller, cutter bar, or handle of the mower in order to sharpen the blades

> Below: The largest automatic power con-At the Transport were according to





Four Wheels for Drive, Brake, and Steering

ACH of the four wheels of this enfique and powerful British car have direct part in driving, brokers, and steeling. The results claimed Divis this system are greater power, safety, and mobility.

POPULIA SCIENCE MONTHLY

This Turbine Power Plant Runs Automatically

PERATING without human cor whot, halting while minor or leuited adjusted, and stop one of the part thing goes curious a warming a few station, at Somehurs

The darbine of the and former a generator with a capacity of 5 (0) borsepower. The only help from human beings is occasignal inspection, lubrication, and regulatiof of the governor mechanism.

The turbine starts when sufficient water arrives and shuts down when the flow inds below an efficient limit.

The high the faction steering syster the good torb it would, in its own The thur when lrive mechanum of the off it if the expest hide with Burffighers Begrt.



Illuminated Mirror Will Make Shaving Easier

DEUSTMENT of the shaving mirror A to reflect adequate light on the face always has been a problem to the selfshaver. Now from England comes a shaving mirror equipped with a small electric lamp that is said to assure the they a period lighteen the correct

The lamp is blaced in the boltom of the mirror and is adjusted so that it illumi-nates only the lower part of the face and protects the syss from glare. It also warms the surface of the mirror slightly and thereby prevents condensation of steam from the busin or bath, with cousequent blurring of the mirror

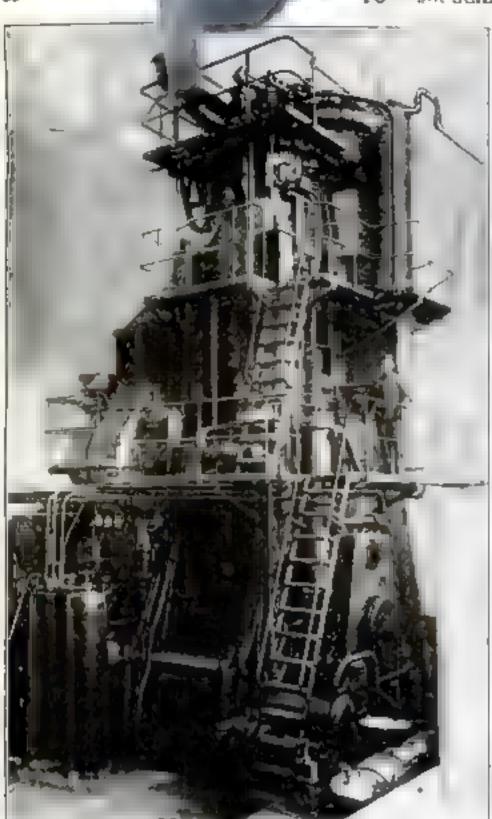
A battery supplies the current, permitting the mirror to be placed wherever desired.

Making Paper Fireproof

DAPER can be made fireproof by saturating it with the following solution: Ammonium sulphate, 8 parts.

Borie acid, 3 parts. Borax, 2 parts. Water, 100 parts.

A solution of sodium tungstate has the same effect, but is more expensive.



Clant single-cylinder model of powerful new marine oil angine

Small Jack Lifts Huge Trucks

A SMALL jack, weighing about 100 pounds, which permits one man to lift and move the heaviest motor trick, has been perfected by a Michigan manufacturer

The lifting apparatus is of the ratchet type, and is controlled with an 80-inch hand, thus permitting the jack to be operated in small space. A few strokes of the handle suffice to rame the truck.

Roller bearings and casters make it easy to move under load.



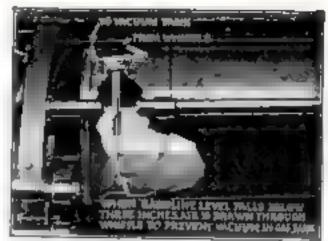
Raising a beavy truck with the 100-pound ratebet jack

HugeEngine Model

HE largest oilengined pascenger vessel in the world, a twinscrew craft of more than 20,000 tons displacement now under construction in a Britzah ahunyard, was made possible by two years of experiment, culminating in a four-month parametric operation of the huge aingle-cylinder model engine. shown at the left,

The principle that made it posnible to produce sufficient power with a single cylinder was that of increasing the cylinder size and producing power with each stroke. Previous types of oil engines were single-acting.

Two monster engines to be installed in the craft new being built will develop 13,400 horsepower



Whistle Sounds a Warning Twhen Gas Runs Low

A BOUT 15 miles before the gas-tank runs dry, a clear, sharp whictle werns the driver of a car equipped with the newly invented gasoline alarm system, shown in the broken-away view above. When the gasoline gets low, the whistle blows intermittently; and when the engine is running on the final filling of the gasoline tank, it blows contamounts.

Within the main pipe hading from the gas-tank to the vacuum tank is a secondary pipe loading from a whatle near the driver and extending to about three inches from his bottom of the main pipe.

When the gusoline level falls below three inches, air is drawn through the secondary pips to prevent a vacuum in the gus-tank. This sir, entering at the whatle, sounds it.

AUTOMOBILE accidents now are a major cause of death, showing a rate of 15 every 100,000 persons, according to the records for 1924



Exhaust Manifold His Cook-Stove

SHORT pieces of pipe, specially constructed ute sils, and a Ford exhaust manufold cook the wayside mesis of J. D. Jackson of Candles N. C., shown above with his ingenious auto coch stove.

A short pipe with an elbowis welled to the manifold Another pipe leads up from theselbow to a sleeve, into which is acrewed a smaller pipe. The cooking vessels have a double button, into which the smallest pipe fits. Heat from the manifold thus is directed against the inner bottom of the vessels.

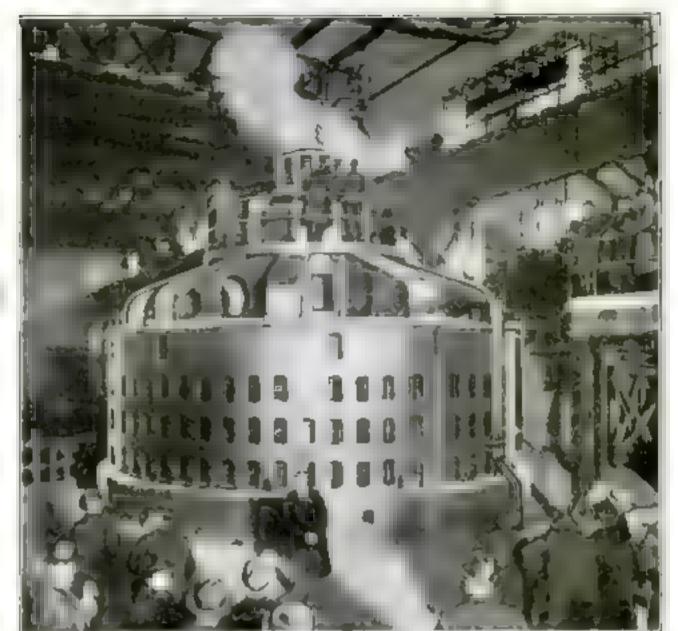
Pre-Heating Manifold for Oulck Auto Starting

Quick Auto Starting

VITH the first extension of her exhaust gas starts are at the time up the dome cap of and only exententive here is granified becomes very heat, thoroughly transforming the spray flung the confe of monifold

against it from the carburetor nossie, it is claimed, into dry, highly explosive vapor, which it delivers to the engine cylinders.

Besides obvisting prolonged manipulation of the choker while warming up the engine, the danger of flooded cylinders, wet plugs, and diluted lubricating oil are eliminated, it is claimed. The attachment is easily installed, no change in the original controls being required. From 25 to 35 miles to a gallon of gasoline is said to be possible with its use



The World's Greatest Water Wheel

The horid's largest and most powerful hydroelectric unit, a guart fortraulic turbine generating 70,000 horsepower, went into action recently at Aviagara

The mammoth

1750 tons and revolving 107 times a mounte, ames 3500 supported it water a second with an encioney claimed to be more than 93 for cent. Exactly this quartery of water was used by the seven 5000-horsepower units that it replaced, so its efficiency is precisely twice as great.

Sugar Cane Harvested by Machine

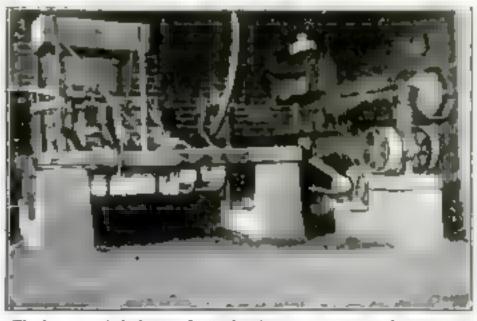
SUGAR cane, which has been cut by hand for centuries, now is harvested by this huge motorized mathire that does the work of 100 men.

The stalk is out the ground by a herizontal circular saw. The loose stalks then are gathered by a series of hooks that can't them to stripping knives, where waste is cut away and disapped into a trailer at the rear.

Old Auto Engine Lights Village

WHEN his automobile became too dilapidated for public appearance, A. F. Hann, of Prairie Home, Neb., used it as a municipal lighting plant. He assembles parrent for twenty-eight 75-watt lights, four 150-watt lights, and two flatirons, and asserts that he could supply toublooke quantity. Just before twinight he started in angine opends at up--- and the town lights ap.

The first are inches istaliation was the purchase of a secondband generator. At lines then cut the car frame down, extending the drive thaft through the rear cross-member of the steel frame and keying it there to a drive pulley to the generator. Engine and generator rest on concrete supports. A strapiron frame surmounts the engine and supports the fuel tank.



The bossemade lighting plant, showing auto engine and generator



Four-Foot Locomotive Pulls Ever Persons

A FILE FOOT car was sa t record to he R. A liarris, Atlanta, Ga., to demonstrate a stead valve he had invented. It is said to h the smallest locometive in the world capable of pulling an adult.

The trucker a rais feet high at the g was a are two comes high If dur full shears a discussion is discussed in politer.

Down to the minutest detail, it is said to be a miniature of the full-sized loco-

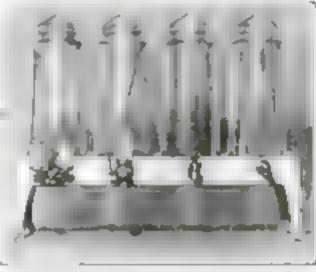
Radio Set Detects Trouble on Power Lines

I ISING a portable rad recept r wy b a loop nortal, trout as house for light and power systems now are they can detect infalabil and trans intom or electricis httikage on tra-state - 1 lines, without the meanity of week the trouble car or of phang foles

The ruthe detectalg apparatus is the discovery of George W. Hammill, supintentions of the Arkansas Vales track massion lines of the Southern Course of Power Company. It is said to company the hazard of climbing poles to hightension wires, and to require fewer men-



Detecting line trouble with radio outfit



The two sode-fountein containers at the left ere equipped with the new depending valves

New Dispensing Valve for the Soda Fountain

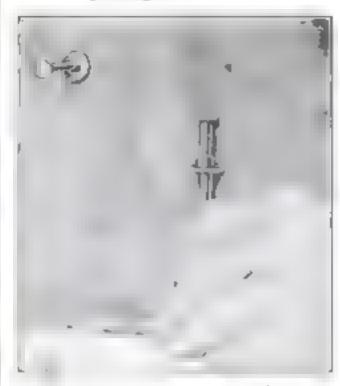
HE annoyance of dripping faucets and the overflowing glasses at the soda fountain has been remodically the invention of a dispensing value. by which a predetermined quantity of any iquid, such as soda and chicolate, may be drawn. Just enough to suit the user's taste will come out of the valve. The cup of the alve

to inventor was it will save time and on tent was at fountains in hotels and restaurants or wherever liquids are dependent small quantities.

were of liquide is controlled by a hardle that opens and closes valves so that an exact quantity will flow into the valve cup.

HE Editor will be glad to supply, wherever possible, the names and addresses of manufacturers of devices mentioned in this issue of POPULAR SCIENCE MONTHLY-

Nall-Pulling Made Easy by Slip-On Collar



O SAVE the lumber lost by splitting when temporary structures age being torn down, and the time lost in pulling recalcitrant nails, these ments nail collars have been invented.

Before the sail if driven, one collars is supped over it, preverting it from interior the wood quite all the way, Thus a hadrour claw can be slipped under the nati, head, removing the null easily.

cent of the time heretofore required for dismantling scaffolding can be saved by use of this invention.

Solid Tires Cushioned by Perforations

RESILIENCY in the solid type of tire required by trucks and other leavy motor vehicles is said to have been achieved by the perforated are mown

A series of holes, closely spaces and more than ar inch in diffrager, circles the tire hear the hear. Houses giving residency with little internal stress upon the rubber, the new tire is said to cool the constant current of sig that is admitted through the holes.



The new solid tire, showing perfecutions



Barling Bomber, World's Greatest Plane, Soon May Be Surpassed

Will the coming summer see new records in the conquest of the cirsurpassing even the amazing feats of aupune construction and operation of a
year ago?

The giant bomber shown above, designed by Walter H. Barling and successfully tested at McCook Field, Dayton, Ohio ast summer, still return its place as the ingress airplane in the world. Yet the United States Army Air Service is reported to have planned the construction of other planes of similar type, but still inger!

With a wing sproad of 120 feet, this giant is said to be capable of carrying enough explosives to wreck any modern city. Its fuselage is 65 feet long and 10 feet in diameter. Driven by six 450-horsepower Liberty engines, it is designed to fly at not less than 90 miles an hour.

Manifold Inlet Valve 1s Designed to Save Gas

ADMITTING air directly lots the manifold in front of the butter ly valve of the carburstor, a new get the saver—an inlet valve—in laint it to effect unusual sconomies

It is attached to the vacture term is nection and extends over the end of blots. When the motor weekl, the action remains tuntly edged permitting as art on a rich mixture. But as the can be warmaup, the heat causes a therm is a in the valve to open gradually. The batter the origine, the leaner will be the mixture entering the carburetor.

The attachment can be instalted in a few minutes, and is claimed not to decrease the power from the engine. It is easily adjustable.



Adjusting the inlet valve attachment



Three Wire Legs Safeguard the Creeping Baby

THE baby on crawl but he cannot full backward, if he is wearing this now guard. Third who detributes to three aturnly wire less that authors a ladded bear fastened about the laby's body.

Advise Diet of Sea Fish to Prevent Goiter

GROWING girls should eat sea fish and shell fish, particularly cysters, clams, and lobsters, several times a week, advisor the United States Fisheries Service, for these foods have a high content of roding, useful in preventing goiter, to which girls are susceptible.

Medical science cays that gotter is caused by the failure of the thyroid gland in the neck to function, because the body is not receiving sufficient lodine. Epidemics of gotter usually are traced to insufficiency of iodine in drinking water. For this reason many communities have added iodine to their water supplies.

All-Season Door Contains Interchangeable Panels

States of the feet in summer and storm to winter—without to being me hanges. This feet is only to being been there consider by interchangeable cloor passes into placed on the market.

The placed on the market of a

terr and attaches panel to the door frame or releases it when it is to be reto year. This operation is said to require less than half a minute.

A wide variety of panels is available, providing an all-season combination door. No planning nor fitting of panels is required.



Removing the storm panel for summer

Labor-Saving Inventions for



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AT gentle A cremus 12 and to broad 1 and 1



fleagante & walks come ob one

Here so new a phastis to set to easy to attach the range of the stor purting frame as a curtain is pulled

the sahm through at hitse respect When only ten on may be removed and washed easily



ther series of the occupants

the Well-Equipped Household



The vegetable and fruit shreshier shown above spill shred ganges for tages inlant. or vegetables for some find graviers. It These separates be from a victor of sites than, laky bits when a ressed against it

The egg holter above at the edu-c n he she par a table resenting

the continued right

productive forap

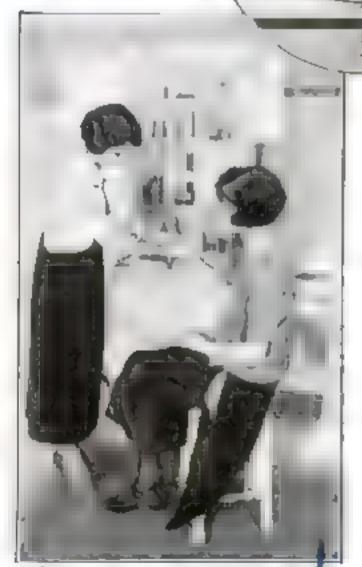
the transfer of the same of th erveren gans bowl int which the beater is inserted



The street of spirit of the that to also have by they of the state of a war about a



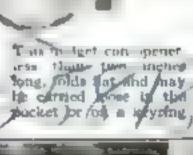
Shears with magnet-IZES PRODUTE TO MAIN A or I want to prom port geetter



A combination dressing table toilet agbinet, and me terme cuest. The front of the large door is a murral. It is fitted with shelles and arguers



Here is an oir unity tempart advisorbe that are expect thy use the time than who travels extens of the gapteral or estanced to have a get without fill ing or wrinkling





This compact electric range cooks food in three vertis and an oven sur taneously. The heating piates radiate heat upward and downward

A reflector place is used to concentrate heat in ope wher this intention so desired. The over the top at the left is equipped with a gage indicatent amount of heat



Locomotive on Runners Hauled by Horsepower

WHEN engineers found it necessary recently to transport a grand locomotive many miles over a ground Canadian prairies the locomotive had to accept help from horses to make the

journey for there was no railroad over which it could transport itself. The eligin was placed on rugged,

The engine was placed on rugged, specially built runners and dragged the entire distance by 12 horses.

World's Largest Insulator Weighs 506 Pounds

increasing dimensions of electric insulators is the giant pictured below, which weighs 506 pounds unfilled alt will be used to introduce conductors into the switch gear one 150,000-mit power transmission station at literaction, Germany. The common duck is 10 feet high and more than two feet in diameter in special sufficient to withstand a pressure of \$20,000 volts in dry weather and from 250,000-to 300,000 volts in wet weather. The of the chief problems encountered in transmitting high-tension current has been to develop insulators capable of withstanding high voltages. This huge insulator represents a recent development.



This giant insulator is 10 feet high



Hinged Spikes Form Stops For Garage Doors

TO PREVENT open garage doors from swinging inward aguest an entering automobils and so changing lenders or windshield, a Mawakace, Wis., shahulacturer has diamed the shope door stop profired above

The details is a thorp-pointed galvanized iron spike proted loosely to the lower rail of the tear. When the door is opened, the spike is dragged along the floor of the entrance. But any motion of the cour inward drives the point of the spike into the floor, preventing the door from swinging

When not in use, the stop fits into a door socket, yet it is easily accessible when the driver wishes to enter the garage.

Fishes Heed Noon Whistle

ADDITIONAL, evidence that fishes are able to hear has been produced by a German scientist. He fed blind fishes to a musical accompaniment. After the sixth day of this treatment, the fishes always came up to the surface when the whistle blew. Once learned, the trick was never forgotten, the fishes always appearing on time during the 30-day test.

Inexpensive Razop Strop Made of Steel

A RAZOR strop under of a thin band of steel, is becoming popular in England, where it recently was placed on the market. It cannot be put and marred,

as can the ordinary to a strop, and is said to be incompanied in

4 Francisco Uant be he the bolet velults, with are said to'le fully out to those fained with the ordinary strop. The method of stropping the razor blade with the new device in unchanged from the old way.



The steel camer strop

Mose than 25,000 birds were banded last year for migration study by the United States Biological Survey

Small Eye-Shades Clipped to Rims of Glasses

Though "blinders" of green celluloid, that can be attached to the rims of eyequation by means of metal chips, are the latest st. is itute for the oldfashioned eye-shade that projected from the forehead

Many of the shader now in time may cause injury, specia and dellares because of the fact that they are attached to the head by an always hard that exerts constant pressure of the prehead and eye

The ting new shades are designed especially for use in reading or other close work, to protect the eyes from glare. It is clear that the smaller shades are less clumsy than were the large ones.



Small collision shades attached to glasses

Fravelers' Wardrobe Trunk Folds into Small Space

JEIGHING only | 20 | pounds and folding to seize that can the carried like a supposed a remarkably compact wardrobe trunk for traveers will hold six women's garments or four men's suits.
It can so more chalfway, placed upon a diair and packed or used as a wardrobe.



Also it will open fully, the bottom and sides making a continuous, flat surface. At the buttom is a compartment for mucoluneous smalt articles. It is equipped with a cover that is said to make it dustproof and waterproof

New Head Phones for Radio Hang on the Ears

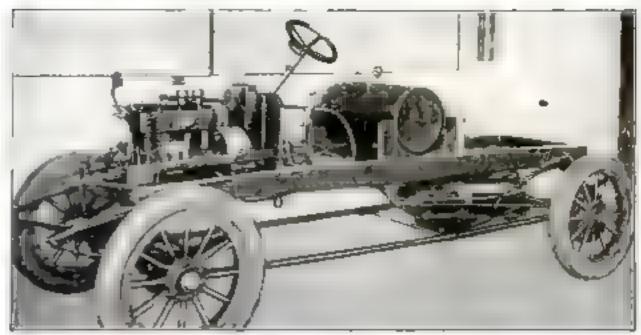
BVIATING the annoying headband of ordinary radio mad phones, newly invented phones that have an the feminine fons, whose prifure the usual headband dispresses. It cannot press he head uncomfortably nor be made teless by a broken headband

The instruments are said to amplify adunds from 15 to 20 per cent. This am-Diffrution in said to result from an air cush on formed between the ear and the daphragm by the unusual construction

of the phone.



How the head phone hangs on the ear



Gearless Auto Is Driven by Compressed Air

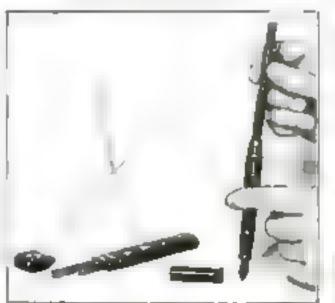
GASOLINE antomobile without radiator, clutch, transmission, drive shalt, or universal joint, has been in vented by H. R. Spangier, of Preblof Colo. The car is propelled by somplessed air.

The power plant us modification of a four-cylinder pascing engine. Two of the cylinders are converted into andur compressor and are driven by the commining two gylinders, which constitute the gas engine. In half a minute the compressor

is said to fill an air tanks to an operating pressure of 50 pounds.

The engine is adjusted to maximum eticience on mataliation. When the resame in the air tank reaches a given mount, the gas engine is shut of automatically. After the pressure drops below 50 pounds, a saring valve permits the sir to return to the air cylinders, forcing the pistors into action and thus serving as a self-starter for the gas engine. In this manner the engine is said to maintain a 50-pound pressure.

The only speed control is a lever on the steering wheel that governs the amount of air passing through a small pipe from the compressors to an air engine on the rear axis that drives the whoels.



Ink Cartridges to Insure a Full Fountain Pen

RV fountain pens have thwarted many a plan and embettered sany

an hour. Perhaps this the case of ink cartridges was the fruit of some such hour. The case equations there metal cartridges, such offswhich can be shipped into the barrel of the men in place of the emptied cartridge. The case can be carried conveniently in the vest pocker, and e certridges are sealed against leakage deterioration of their contents.

A slight turn of the cartridge after it has been inserted in the pen tightens it.

Charcoal Gas Drives Auto

N AUTOMOBILE propelled by gas generated from the combustion of chargoal was tested recently in Lyons, France, before government officials and technical experts. The machine is reported to have traveled 60 miles on 33 pounds of charcoal costing 25 cents, or one fourth the cost of gasoline. The charcoal gas is generated in a furnace compartment.

Cane Holds Baby Carriage

COLLAPSIBLE buby-carriage attachment and a walking wirk day beat devised by an infentive Landay The Organistic of such at Surance to stick by two the ninterests. (inter not in use it can be fulled that



Carriage fastaned to the walking-stick



Rubber Heart Beats in Lifelike Model Cow

A MODEL cow of ble size with side cut away to reveal internal organs are by a circulatory system constructed of their ruther, through to cheblood ran, was a feature of a record as hint by the United States Department of Agriculture. A rubber heart actual by an air pump, simulated the pulsations of the actual circulatory system



carries to the udder, where they are built up into mak proteins.

Projector Shows Pictures in Three Dimensions

THE spectral effect of this hand, reproduced on the wall in viving lifelike form, is the achievement a a threedimensional projecting machine recently perfected in Germany

Until repently methods of projection have shown the projected objects as two-thmensional. The old-fashioned stereo-geope gare three dimensions, but it was not a projector. This new invention is mad to achieve depth or perspective and without the use of a screen.

The litustration reveals how startlingly accurate is this projection. Each wrinkle and vein are clearly visible on the hand, which has been greatly enlarged by the projector in reproduction.



Projecting a hand in lifetile dimensions



Offers Plan to Forecast and Chart Earthquakes

CARTHQUAKES will be foresast as necurately as storms now are if Major Wilham Bowis, for the timed States Coast and Goodelic Survey, achieves the results he expects for married charting earth transcript, in all value.

Basing he theorem on a painstaking correlation of a known facts about earthquixes, he believes he has developed a reasonably desendable system. It is expected that shortly he will be placed at the head of the country's first earthquake station. The photograph shows him charting the probable effects of a predicted minor quake

Discovery of a fluid that, when injected into the blood, strengthens the white corpuscies against disease, is claimed by Dr. Burr Ferguson, of the United States Health Department. The fluid, he says, is based on salicylate of mercury

Four-Inch African Locust Feeds on Mice



bold mice, you might try a locust. Of course an ordinary field locust would not do, but the species shown shove, four mehes long, would

This African Insect, caught while feeding upon a mouse, was killed and, with his victim still in his clutch, was taken to the South Kensington Museum, London. The species is said to be the only insect that feeds on four-footed animals.

Mammoth Lens Made for Movies of Mars

Morion-Pictures of the planet Mare will be taken this summer, if the plane of Dr. David Todd, of Amherst College, mature. In August, when the feat will be attempted, Mare will be assert than it has been in 100 years, and nearer than it was be within the next 500 years, attronomers tell and a specially constructed \$100 camera.

A specially constructed \$ 000 camera and a reflecting ten scored using the largest lens ever ground for one of its type, will be used a This frant lens, five feet two and a half derive in diameter, was beginninhed at the American University, Washington, D. C., in 1903, by Rev. Dr. John splate, a retired minister, who made

The negative to be obtained, even after three enlargements, probably will be about the width of a dime. With good fortune, it nught be wide as a quarter.



Warld's largest reflecting telescope fone

A Creature Four Hundred Million Years Old

FOUR hundred million years ago, a time so hoary that only the oldest rocks bear any record of it, this curious,



long - extinct creature, a tralobite, was one of the highest forms of life our earth housted

Thus specimen, now in the

Field Museum of Natural hattow, Thicago, was found in northern New York, where it had lain, density lungil, since Pale slore time. It menown could up, the top half being the hand and plimower had the rear part of the creature

Projected by his jointed, armor-like shell the truobite crawled mong the Not form of primeval seas and along their betches.

Deny Increase in Insanity

THAT alcoholte insanity has increased since prohibition is emphatically denied in a bulletin of the National Committee for Montal Hygiene, which states that as compared with 1919, the year 1922 shows a decrease in mental cases from this cause.

Data from 100 hospitals for mental disease showed that of 35,000 cases in 1922, less than four per cent were the result of alcoholism, the report says.

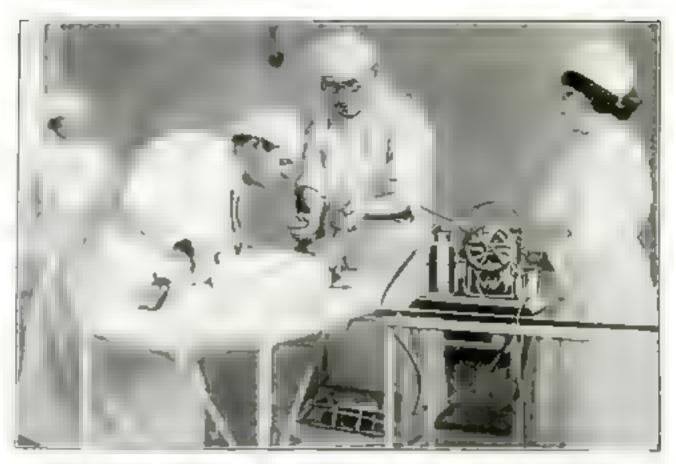
The World's Tallest Cabbage

THE treelike vegetable pictured below is said to be the ta lest countda kund of cablings—ever grown. It is approximately that year old and in them feet its inches high

The glant point from the form of J. W Harkey, hear Sanford, Fla.



Giant collard, mearly eight feet tall



Electric Pump Is Victor over Diphtheria

TINY electric suction pump is the letest scientific weapon against the scourge of diphtheria. It is seed to have reduced the danger rate of this design from 3312 per sent, to 10 fer rent at the Kingston Avenue Hospital Brothlyn, N. Y., the first at thousion to adopt it

The life of ave-year-old Muriel Carlson, of Brooklyn, was saved recently by its prompt use. Her throat was nearly closed

and her breathigg barely perceptible when the new instrument was set to work. Almost pararily the pump loosened the throat membrane and within a few minutes a giver freathing tube could be Inserten

The pump, the invention of Dr. H. L. Lynah, of New York City, is expected to save the lives of many thousands annually throughout the country



New Turkey May Add Zest to Thanksgiving

LAVOR of the nation's Than briving turkey may be improved by uner-ments undertaken by the United Stabs Biological Survey) which is trying to chimate the occilated of anotted turker—a wird species of Control Aburrea. A numher of the birds ecently have been transplanted to a longly island of the Georgia coast. If this effort is successful, attempts will be rouse to breed it with our domesti-

cated turkey which is of Mexican origin.
The observed turkey takes its name form the "eyes" sprinkled over its gorredus tail feathers. Few feathered creatures surpass it in beauty of plumage. Its back is blue tipped with red, and its wing coverts, legs, and feet are a handsome red.

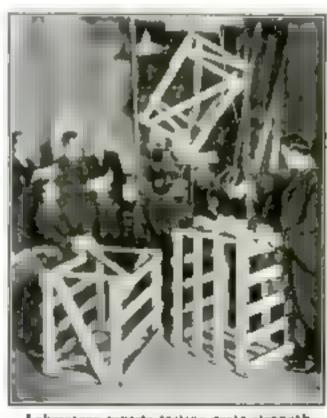
The bird is shy, but prefers the open to the woods. It is about the size of our own turkey, and the meat is said to be unusually tender and savory.

The Strongest Crate Made with the Least Lumber

THREE common styles of crate bracing were subjected to rigorous tests recently by the Forest Products Laboratory of the United States Forest Service, at Madson, Win.

The arate with a hingle diagonal bases on each side the one shown below the test, withstood double the diagonal conspression that distoyled the write on the floor of the right. It offered a maximum of figidity with minimum lumber.

A combination of diagonal and parallel bracing was found to be desirable only in packing certain rigid contents.



Laboratory experts tosting crate strongth.



Auto Sidelight to Assure Safe Clearance

A POWERFUL green light, claimed to be visible twice as far as auto head-lights in any weather is directed forward by this new side safety. I pract of to the running order of the running for
The green light a said to be the giare of head or that the attention of the car sextreme edge

Moreover, it creates a safety zone of



Aluminum Tripod Gives Cushioning Support

A PNEUMATIC tube in back a supporting post moves up and down on an air cush only an unasquit mprovement in this himpact and un numeramera traped. The pneumatic cushion permits adjustments in the one hand without by or friedrich.

by or frietiby

When closed, the tripod is 24 inches long and autinches of diameter. It can be folded into a mutcase. It has a large, detachable head, bracing any size or make of

CAPROTA.

white light six feet long and 14 inches wide, indicating its approaching drivers had closely that may pass. Their near wirels can be the center of this zone, with the inches in spare

The light is attached close to the front female on the side of the left running-board. Thus the driver always can determine, by leaning over slightly, whether it is burning. The red light substitutes for the tail light if the latter goes out

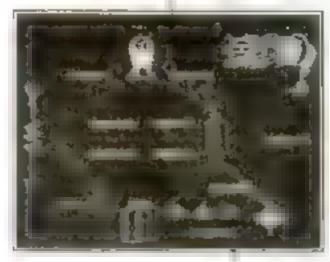
Hot Pluge Aid Starting

ONE reason why an automobile engine is more apt to balk when starting than after a period of continuous running has been determined by Dr. F. B. Silsbee, of the United States Bureau of Standards for the National Committee for Aeronautics. He has found that the ignition spark will pass more readily when one or both of the electrodes are heated to red ness

This effect is stated to be independent of the temperature of the gasoline mixture

Spark plugs that make the electrodes run hot therefore are the most efficient

Illuminated Display/Shows Secrets of Radio



THE theory and operation of a popular reflex radio circuit was represented strikingly in a novel illuminated diffusy at a recent radio show

The circuit was shown at a rombination diagram and pictorial representation, the apparatus being unicated by a matranaparencies and the currents in the various circuits by manufactured Orbitaler tubes.

While all these tubes are lighted in the photograph to about meir positions, in the action working of the model the various circuit, are builted progressively to reveal the action of the currents at various stages of the operation of the circuit.

The this play was designed and built by William J School and W H Farr.

Cigarette Box and Stand

A HANDY eigerette box of figured wood is constructed in such a way as to open in the furm of in X—sped

at and when
pressure in appried to annien!
of the boar
two have
the boar are
the



Motorized Platform Replaces Switch Engine

THE costly use of a large locomotive and from two to four men to shant a few empty box care has been a source of transportation waste for years. The coal famine in Germany finally forced a solution of the problem, in the form all shunting platform albut the six of in ordinary hapficar, driven by storage battery.

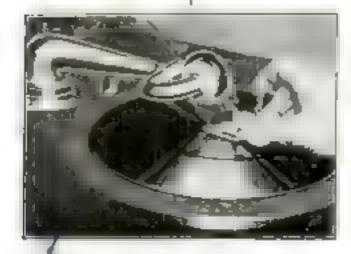
The platform carries the battery, two driving motors a separate motor for the capstan, rolly life the rope, and footboards

from which the driver directs operations. The capstan makes it possible for the platifier, from a stationary position, to move that and to turn them on a turntable, to turn a rar, one end is connected with the caustan by a rope. The motor then windwithe rope.

The lattery has a capacity of 158 ampere-hours for three hours. The platform can move a loaded car or several empties. Its maximum speed in about five miles an hour.

The small but powerful meteriori platform hauling a loaded freight our and three empty cars

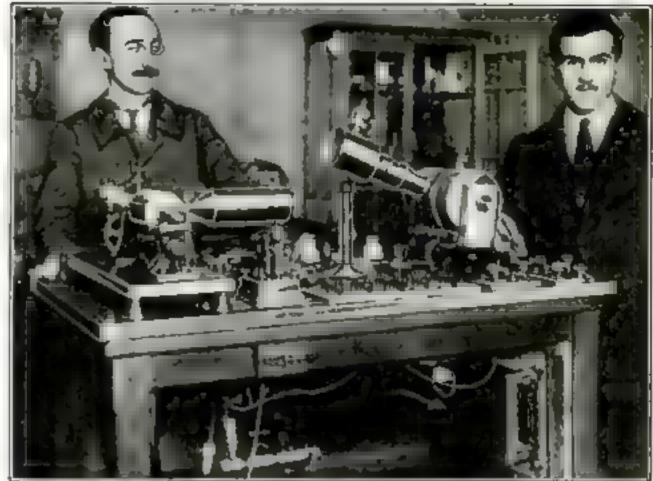
Fiber Needles Sharpened on the Phonograph



sharpened without remarks freid the tone arm through the invention of an ingenious new ruettle cutter. Since needles of this type apreferred to many because of their mellow tone -must be sharpened after completing one or two records, the need for removal heretofore has been an annoyance.

with this new afterpener the needle is support into the cutter and the lever present down once. A dust and shavings bound tached to the cutter catches the chips.

Only a very small portion is cut at one trimming, so that one needle can be used to play many records



Check Signatures Transmitted by Telegraph

HANDWRITING now is to be transmitted by telegraphy as a region service by the French Post Office Department. Already French hanks are honoring telegraphed checks, it a perfect retrai pel teledictrically over the waren.

One dustration shows the belingraph to consister, which the actually is be appreciated in many French post offices.

Drowning Mouse Sets Trap for Others

TOTTURE durged prepared by the arch villens of his pre and romance laborinths with the passages and stair-

Rear view of trap, showing death stairway

ways with false floors that plunged unsuspecting victims into the pit of death — these had nothing on the newset of mouse-traps.

commonest of household patts not be the ry best mouse-traperer anyented, but

undoubtedly it is one of the most intricate. It is arranged so that the mouse, after he has been lured into it, not only shuts and locks the door after him, but all innocently resets the trap for his brothers to follow him to his doors.

The mouse enters the front door of the chamber and moves along a passageway in an attempt to reach the buit, which is guarded by a perforated metal container

As he progresses, his weight on a movable platform automatically closes and locks the door of the entrance behind him. The only apparent exit is an opening at the rear of the passageway, leading to a ladder. To reach the opening the mouse must climb over another hovable platform that automatically reopens the entrance door for another mouse

Kowlif the trapped noise should attempt to expect his teps and escape though the superied chor, the door will be thosed in his face automatically by the please of his weight from the putform. It is eventually he must climb up the ladder. When he reaches the top, freedom apparently is in eight. At the far end of a level upper passage is a small opening through which shines the light of day He dashes along the passage, pushes his nose into the opening and—splash! He plunges headlong into the water of a subterranean well from which there is no rescue

The contact of his none with the opening has sprung a trapdoor that has dropped him to his death

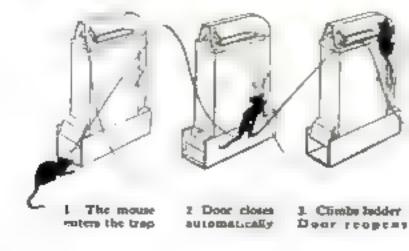
And in this last earthly act be has unknowingly reset the trap, preparing the same fate for one of his companions.

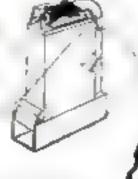


Pictures Biblical Stories in Grotto of Rocks

A HUGE grotto built by hand of every kind of stone, mineral, fossil, petrified substance, shell and coral to be found in the United States in the exacting hobby of Rey, P M Debberatein of West Bend, Iour.

Primarily however, the chucker is not a scological exhibit but a scorogical exhibit but a scorogic-turnation of familiar philate of Broncal history, including the story of creation. The Eden scoroe already is completed, and several others are well under way. The builder estimates that from six to eight years will complete the undertaking.

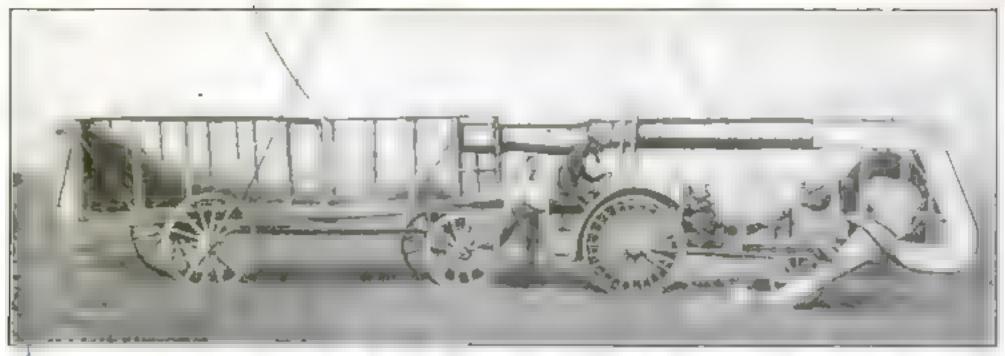




4. The dash for freedom

5. Paral plunge

Cracks trap



Mammoth Machine Harvests 300 Bushels of Clover Seed an Hour

an hour can be harvested by the cumarkable combination sweeper cleaner, and packer, according to it inventor. A. F. Raff, of Rock Hill, 6 Phy hay a left, to be raked into windrows.

gonous mechanism A suction fan nounted in a tracted with flexible and adjustable intake, sucks the feed from the ground and deposits at in the

s light-framed

PART WARON

The inventor, shown in the picture holding one of his children, announces his willingness to help any interested farmer to build one, offering full instructions.

Bumper Stops the Car that Strikes Pedestrian

MOTORISTS who strike pedestrians or other cars and escape before they are identified might drive more carefully in a city that required on all cars a new automatic humper attachment invented by E. R. Stump, of Seatte, Wast, and pictured below

Any sudden impact on that profects slightly shead of the buneder instantly short circuits one at the warner, stopping the sheat Beam the above can start again. To must suight and reset the awitch givent bustanties or an officer whole apportunity to note his accesse hundered question him.

This automatic stopping of the car, it

This automatic stopping of the car, it is mid, would project particularly those academic in which the victim is dragged a conditionable distance.

Seattle traffic officers who recently demonstrated the device declared that if legislation could be passed compelling its use throughout the country it would be practically impossible for a motorist who strikes a pedestrian to escape.



Short-circulting har ahead of bumper



by Pulling a Tab

ONE pull on a metal tab ties these galoshes anugly over the wanter's shoes without the need of buckles or other fasteners.

The thumb and forefinger merely sull up the jan, through a saferproof and domfortable fastening Adding down the fathunicaks the justening.

The tab perales by engaging or disengaging specially designed teeth on each and of the opening. The principle is used has widely known type of tobacco pouch, also on bags and dresses.

Arrow Poison for Insects

TUBA root, which was used by the "Wild Men of Borneo" as an arrow poison, and is still used in the Malay States as a fish poison, is a most effective insecticids, according to recent experiments in England. Experts hope by its use to relieve the shortage of nicotine, the best insecticide known.

Phone Wires Cross Lake on Pontoon Poles

RACED with
the problem
of running a
telephone line
acress a lake,
the fire chief of
the Santiam
National Forent a Occurre
determined to
oversime the
difficulty

Setting the poles in the lake bottom failed, because the lee pulled them up. He then built log rafts, two

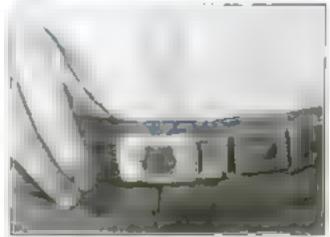


Anchored caft and pole

every hundred yards, upon which the poles were erected and guyed with diagonal braces. Each raft is anchored with heavy stones and wires.

√n Elastic Belt Buckle

RELIEVE the discomfort sometimes caused by a helt, is novel clastic metal buckle possibly invested gives and stretches recording to the strain places upon it. The usefulness of this facture discloubted y is noticeable aftern repeatedly hearty meal



The new elastic metal bult buckle



World's Greatest Loudspeaker Can Be Heard Four Miles Away

The state of courses and is 12 feet square and 35 installed at Oakland, Calif., is said to great the state of the a designing device is placed at the throat of the a distance of four miles, and faintly for even a great place.

Automatic Traffic Signal Has Bell and Lights

BY MEANS of an electrical timing device, a new traffic signal can be operated auto-



matically, or as one of a number of simliar signals operated from a central, control board.

The STOP sign

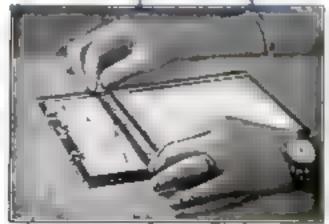
swings as a track slong one side of the control box. As it swings, red and thue lights attempts, indicating "stop" and "go." A loud gong rings at each change

The automatic timer and the signal both are motor driven through worm gear

Writing Aid for the Blind

A DOUBLE guide bay that runs along the side rails of a frame containing letter paper has been devised to aid blind persons to write letters with lines straight and regularly spaced.

The write fluger of the pen fland follows along the lower step of the kinning bar. The bar a moved from high to like, a peg at each side of the game dropping into corresponding holds.



Latter-writing guide for the blind



Engineer's Shovel "Rings Up" Weight of Coal

ENGINEER BILL DECAMP, of the Baltimore & Chio Railroad, has need it possible for the furnace tender to fing up every load of fuel his shoved three sinto the firebox. It working out a decorate for the purpose, he has applied the processes of the real merchant.

Decamp's Invention consists of a counter placed in the handle of the scoop showel used by the locomotive fireman, as shown above. This counter is operated by the pressure of the weight of coal Without the weight, the register does not operate, and for this reason the shovel may be used for cleaning up without interfering with the coal record.

Electric Soldering-Iron the Y Size of a Pencil

A PENCIL-LIKE electric souteringnon, only eight inches long, has been perfected to simplify home soldering tasks, especially the fine work required in soldering radio connections. It is plugged into an electric-light socket

The iron, constructed entirely of metal, is fitted with a German silver tip that is said to assure a smooth, clean surface at all times. Eight feet of cord wire is provided it is protected at the top of the handle by a lust metal entire contact prevents frawing of the wife at this tipe positi

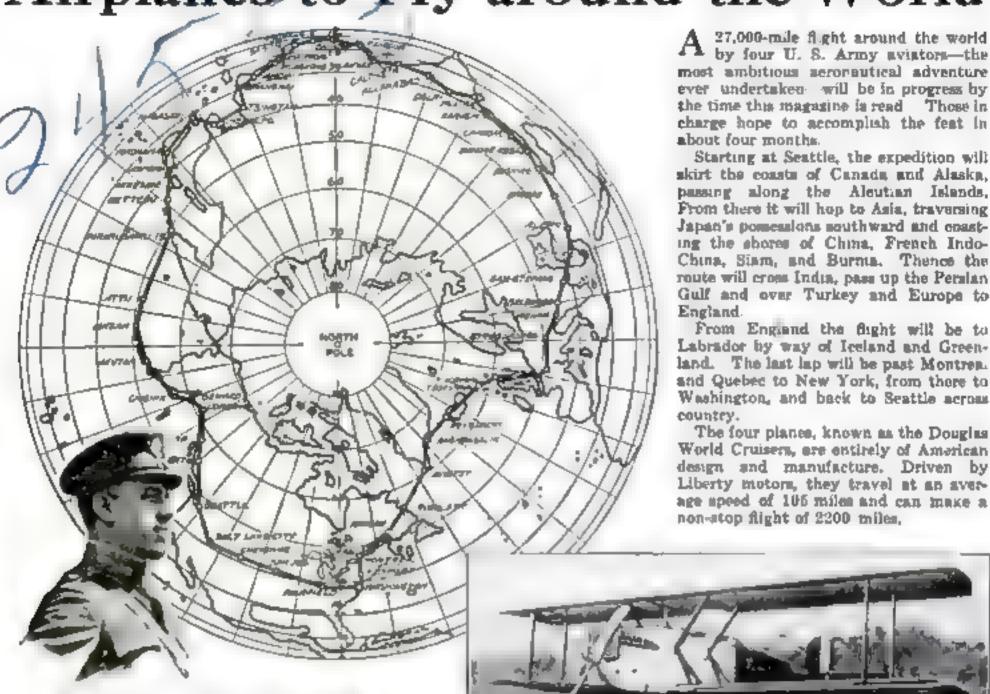
Amached to the other endful the sord wise is a plug connection holding a standard electric-light bulb for resistance purposes. This feature offers the advantage of both heat and light without additional operating costs and permits the regulation of the heat.

Two interchangeable tips are provided, one for coarse work, the other for fine work. The lower third of the iron is flexible. The handle never becomes hot, according to the inventor



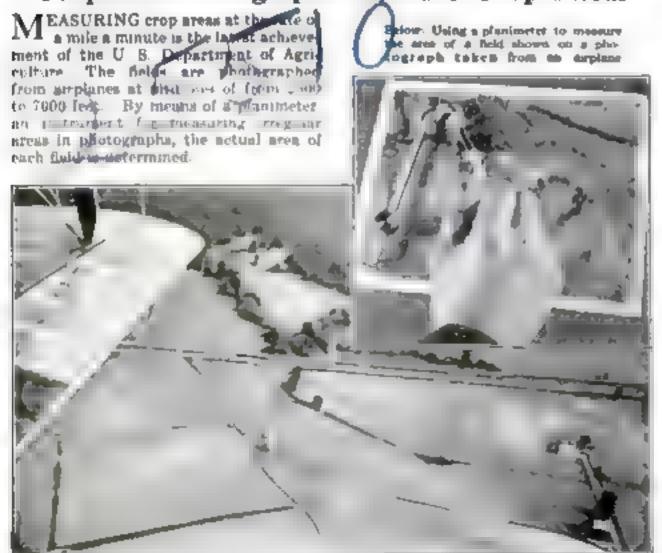
Soldering a radio candenser sonnection

Airplanes to Fly around the World



Airplane Photographs Measure Crop Areas

The map shows the route that the Dougles World Cruisers plan to follow in their attempted flight around the world starting and ending at Sentile. Wash. At the right is one of the four sirplanes especially designed for the trip. Major F L. Martin limit) will communed the flight of \$7,000 mules.



Recent Publications

A résumé of new books on science and invention

Science Remaking the World, edited by Otis W. Caldwell, Ph D, and Edwin E. Slosson, Ph D. Sixteen illustrated articles prepared by as many distinguished educators and scientific workers and relating the atory of the wide range of modern science and its influence on human life. Doubleday, Page and Co.

Stories of Scientific Discovery, by D. B. Hammond. Biographies of a dozen great pioneers of science, ancient and modern. The Macmillan Company.

The New Decalogue of Science, by Albert Edward Wiggam. A journey through the fields of modern science, particularly biology, psychology and anthropology. The Bobbs-Merrill Company

Phonograph Construction, by E. M. Winterbourne. Detailed, easily understood instructions for the design and building of talking machines. The Bruco Publishing Company.

Automotive Trade Training, by Ray F Kuns. A comprehensive automobile handbook. Revised Edition. The Bruce Publishing Company.

Queen of Dirigibles Ready for U.S.

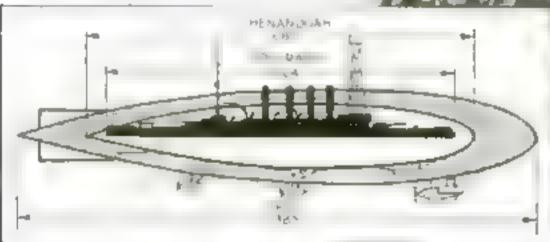
THE monster 2R 8 the United States naval dirigible now rapidly nearing completion at Friedrichshafen, Germany, birthplace of the Zeppelin, is to be sailed home across the Atlantic, some time chis apring, by a picked crew of 30 men-

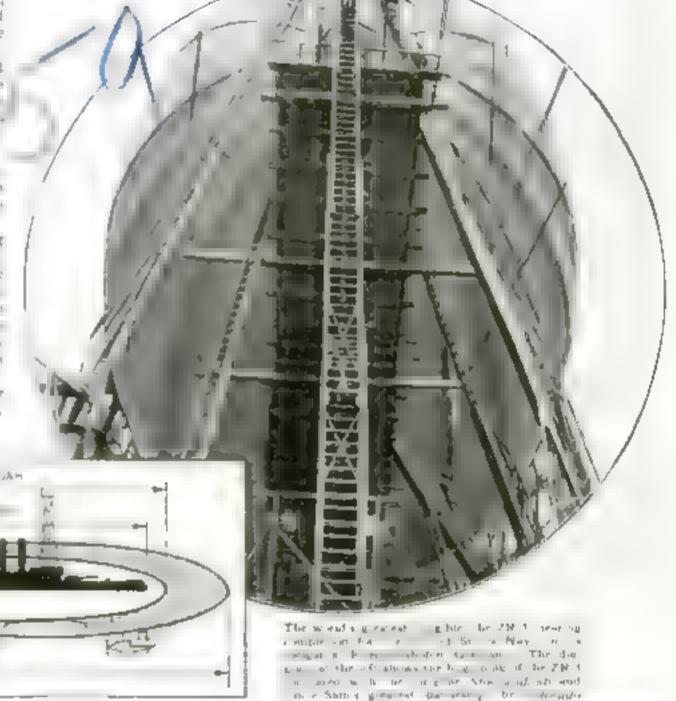
In every way this latest serial grant overshadows the now famous dirigible No indeah, formerly the 2R-1 two feet long and 130 feet high as corepane with the world agt a for all of a light owner.

or and core par recept had trouble with a ser to And the suffer perfective

in the state of the west net is ex affine it at the set is the strains att so to e rating the length of the ZR 3 with that of the battle -t ; were , the latest and tion to be Dames and the battle floot The enger of the force or hald feet -only about two-thirds as long as the world's ryghteest arrebig

The ZR-3 was sched and to take the air. for its first engine tests during the early part of Apri





Amundsen's Polar Flight To Be for Norway

WITH the indefinite postponement of official plans for the transpolar flight of the United States navy dirigible Shenandook, interest in centering in the spectacular attempt of Captain Roald Amundsen and his Norwegian expedition to reach the North Pole and to discover uncharted territory in the Arctic by airplane during the coming summer.

A recent report that Captain Amundsen would recognize a claim by the United States to any new territory he might discover was met by an emphatic denial in a statement by Arne K.ldal, official Norwegian press representative of the expedi-

tion in America

"Captain Amundsen declares that he has in no way given his consent to any annexation of such for the benefit of the United States," the statement says, "and that the possession of all the land that he or his expedition may discover naturally will be taken in the name of his Majesty, the King of Norway,"

The Amundsen expedition plans to start from Spitzbergen in June, to cross the polar regions, and return by way of Alaska. An American navy officer, Lieut. Ralph Eugene Davison, will be a member

of the expedition.

How Much Science Do You Know?

IN THE ampliest, most obvious, every-day happenings often lie hidden the most fuscinating scientific facts, wholly unknown to you

The knowledge of one apparently commonpace fact about the hidden forces of nature after becomes a skeleton key to open many doors of scientific understanding that will atimulate your mind, give you confidence, and win the respect of others.

Read the dozen questions below. Answer them to the best of your ability. Then turn to page 143 and see how nearly you were right.

 Why do you feel more active on a cold, bright day than on a damp, cloudy one?

2. How do we know that the regions around the North and South Poles once were warm?

3. Why does silver turn black when exposed for a long time

4. Is there such a thing as invisible light? What physical changes are caused by fear?

What causes a water mirage?

7. What is the remnant of a third eye inside our brain? 8. Why are white clothes cooler than black ones in the tropics?

9. How did scientists determine the earth's weight?

10. What poison is so strong that a spoonful could kill every one on earth?

11. How do gases, liquids, and solids differ? 12. Are hunches usually right?



The window-mak should be well protected with paint. While one cont rovers if a dark color is said two routs are necessary for a paint film that will withstand the weather



The simplest way to stipple a pointed well.

The second contracting color to applied with
a damp apongs, which is cut with accesses to
produce the deared design for the stipple



If yours is a shingle bount, or if its body color is durk with light thro. the bount cust be freshened up by giving the trim a cost of point, which size serves to protect the wood

Spring Painting—Inside and Out

By N. M. Collart

Painting—to a person who never has done any—probably appears to be the simplest work in the world. In a way, that is correct. The mere set of dipping a brush into a can and covering a surface can be done in a more or less satisfactory manner by any one after a little practice. But read painting, that will provide protection, decoration, and a surface that won't peel, crack, bilster, discolor, or otherwise show signs of wear before its time—that is a different matter.

Real painting depends almost entirely on using the right kind of paint, especially for the first, or priming, coat. Given the proper paint for a particular job there is no reason why the ordinary than or woman, with a little case, should a turn out a job that would do credit to a professional.

When you consider that three costs of paint make whim only 8/1000 of an such thick — about as there as a sheet of writing-paper—It is obvious that to give proper protection your paint must contain the best materials, and that the various ingredients—pure raw inseed oil, pure turpentine, dryer, and pigment must be mixed in correct proportions, according to the kind of wood it is to cover.

IN THIS connection I recall the experience of a friend of mine who sought my advice in repainting his house not long ago. The original painting job had been unsatisfactory. What bothered him most was the fact that the paint had peeled from some parts of the house and not from others.

I soon found the reason. The trim was of white pine, while the walls were of cypress siding. On the pine the paint had stayed firm, but it had peeled from the cypress. This was quite natural, considering the kind of paint used in the original job.

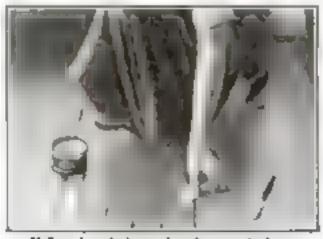
Pine is a normal wood, which takes

This is the time of year when the thoughts of householders turn naturally to painting. The winter has left its marks on the outside of your home. Here and there the paint that looked so well last autumn has faded. But haps it has even disappaired having oreas of here wood.

Or it may be that imade the house the walls floors, builings woodwork and furniture are

woodwork and furniture are showing signs of wear and the Do you know how to so about removing these unnightly thinger spots with point? In the accompanying article, at M Collect, a nethodally known expert, describes how the amateur can pendern almost every conceivable abot of painting job.

and holds paint well. If the knots are well shellscked before painting to prevent pitch from "bleeding" through, any good paint applied to pine with ordinary care gives a serviceable job. Cypress, though, is very oily. If a primer suitable for pine—that is, a primer rich in pure raw linseed oil—is used on cypress, so was the case on



If floor boards have shrunk so as to leave unaughtly cracks, the remedy so to force paste filler into the cracks with a leaste of with the thomb, after the first cost of paint, has been applied. Allow the filler to dry thoroughly before applying the second cost,

my friend's house, it will not penetrate the wood, but will dry more or less on the surface. Then, when the paint film becomes hard, it lesses its elasticity, tending to chip or prel off

I advised my friend to prime his cypress walls with a mixture of two quarts of pure turpentine and a quart of linseed oil to a gallon of ready mixed paint. The turpertine penetrates the cypress, carrying the paint with it and providing a groundwork on which the top costs can be spread smoothly and more or less permanently.

Had the siding been redwood, cedar, or some other porous wood, I should have advised him to make his primer of a gallon of pure raw inseed oil, a quart of turpentine, and a gallon of paint. This oil would satisfy the natural absorption of the wood, and prevent the wood from robbing the top coats of their oil. For the top coats the paint should be applied just as it romes from the can

THE most important part of all painting in priming, putting on a correct first coat, for if the primer lets go, off come the top coats as well. A simple rule to follow is to use plenty of turpentine for oily woods and plenty of oil for spongy woods.

I also pointed out to my friend the danger spots about his bouse—the places where especial care is necessary in painting. Chief among these is the porch. The porch floor and steps really should be painted every spring, for they are a ready prey to the weather.

The base of wood columns should be puttied tightly and well painted to prevent water from settling underneath and rotting the wood. Joints on railings and window-sash likewise afford entry places for water and decay, unless kept well painted and puttied.

The bottoms of outside doors are hard to get at, but, if these are not painted, the doors are likely to take up mousture and to swell and stick

In all of this work my advice is not to economize on either paint or brushes. Buy the best. A few extra dollars spent on good paint and good brushes will save many dollars in carpenter's bills.

There are so many kinds of interior painting that it would be impossible to describe them all in detail here. For woodwork, the full variable finish—the "piano finish"—and a bed is the goal of most persons in decerating their homes. And most persons fall short of this goal simply because they do not precede the application of variable with subscient sandpapering and because they fail to keep the surface free from dust and dirt.

A CLEAN brush is absolutely necessary in varnishing. Before starting work, wash the brush in a mixture of linseed oil and turpentine, and squeeze dry. After this, pour out about half a cupful of your varnish, dip the brush into it and scrape it over the edge of another cup. By the time the varnish has been transferred from the first cup to the second, the brush will be clean enough for use.

Brush on the varnish freely and quickly "with" the grain of the wood. Then, without dipping the brush into the varnish, "lay off" the surface by brushing atraight across the grain. This spreads the varnish to an even thickness and covers any spots you may have missed the first time. Finally the surface is "straight-ened out" by brushing once more with the grain.

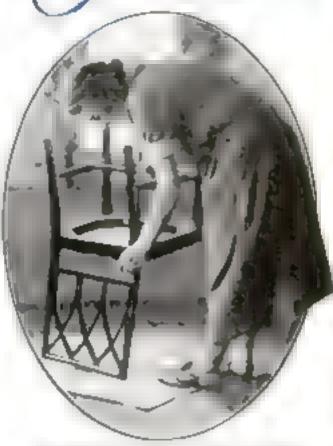
To obtain a duli finish, surfaces having a glossy finish may be rubbed with powdered pumice-stone and rubbing oil, or sewing-machine oil. Make a pad of soft cloth and wet it well with oil. Dip this into the saucer holding the powdered pumice-stone and rub the varnish with a light, steady, even pressure, always "with" the grain. A dozen strokes back and forth may be sufficient to produce a dull finish. As a last step, wipe the surface dry with a soft, clean cloth.

DULL-DRYING varnish also may be used to obtain a dull finish. The surface should be rubbed lightly with No. 00 sandpaper before the varnish is applied, to cut the gloss. Dull-drying varnish is particularly useful in conjunction with staining, preserving the natural "woody" look and texture of the surface—"weathered oak" and "furned oak," for example. This finish is practical and durable.

Varnish-stain, which, as its name implies, serves a double purpose, is applied easily, and for that reason appeals strongly to the amateur wood-finisher Through its use the old golden-oak plece that you have been considering discarding can be disguised as walnut or mahogany and earn a place with your best modern furniture. The furniture should be wiped off well with gasoline or benzine, and rubbed with sandpaper before the varmish-stain is used. I have seen good graining effects produced in conjunction with colored varnish by drawing an old whisk broom through the varnish before it had not.

Enamel must be "built up." That is to say, the surface you are to enamel must be covered first with a solid, opaque paint called "enamel undercoater." For best results, this undercoater should be tinted to match the color of the enamel. Enamel should be applied in a warm room and brushed on exactly like varnish. An ordinary bristle brush is too still and coarse, and will leave brush mans. To wood mess a good atch or oxhair brush should be used.

Floors must be refinished occasionally Hardwood floors may be treated either with varies or challes. Shellar dress quickly, but is rather expensive. It is



The right way to varnish or enamel a chair; After suping it clean hold the chair upside down, painting the legs first. This not only affords us easy means of holding it, but lower the top -the most important part -- to be pointed but. Does the effect to bright out the varnish web, to avoid "rune"

brittle and will discolor if wet with water, though some people prefer it because pure white shellar does not darken the wood or otherwise change its appearance. Good floor varnish is tough, waterproof, will not scratch white and usually is pale enough not to alter the color of the wood or linoleum.

When you have made your choice between varnish or shellac for your floors, stick to it. Never lay on a first coat of varnish and finish with shellac.

If your floors are oak, they will require filling with a paste wood filler before refinishing, since oak is an open grain wood. Floor varnish should be applied exactly



The beauty of loary or Preach gray enamel furniture is brought out emply by color stepping and using unit stepcial potterns, or shown above. Afterward, you can put in by hand a few touches, such as stems, buds, and high lights not in the original pattern.

like furniture varnish—freely and quickly with the grain, then "laid off" across the grain and "straightened out" by brushing once more with the grain.

Old floors of soft wood can be made attractive with paint, or they may be treated with varnish stain by the method described for furniture. Should the floor heards to hadly shrunk, the cracks must be fixed with paste filler after the first cost. Brush the first cost well down into the cracks; otherwise the wood may dry out the filler and cause it to loosen and come out.

The processes I have described may be applied to interior trim, doors, shutters, steps, banisters, railings and so on, according to their original finish or the finish desired

With a little paint and trouble, your cellar can be made quite as attractive and habitable as any other part of the house. Two coats of concrete paint, which can be obtained in a variety of colors, not only will bring an end to the cement dust that collects on your cellar floor, but will make the cellar bright and cleanly. Before applying this paint, wash the cellar floor with a bose and let it dry thoroughly.

ALUMINUM paint will give a durable finish to your furnace, water boiler, and water pipes. It is a good plan to identify your piping system by painting hot water or steam pipes red, cold water pipes blue and gas pipes green. Cold water paint on the walls also will add to the attractiveness of the cellar.

Painted wall finishes recently have become popular, particularly the stippled
effect resembling high grade wallpaper.
Stippling can be done easily. A background or foundation color of some fint
wall paint is applied and permitted to
harden. Over this is printed a contrasting
color of paint that is rolled or crumpled
while still wet by patting with a wad of
newspaper or cloth, applied with a light
twisting motion of the hand.

NOTHER way of producing this A effect as by applying the contrasting color with a damp sponge. The paint is rubbed onto a board or newspaper, from which it is taken by the sponge and "printed" on the wall, the sponge reproducing its own texture in the contrasting color. It is well to make several test prints before applying the paint to the wall, trimming the sponge with a scissors until you have obtained a suitable design, The selection of colors for stippling, of course, is a matter of personal preference, but it is advisable not to make too harsh. a contrast between the background color and that selected for stippling.

In this brief survey of home decoration there are two materials I have not mentioned, although no painting job can be finished successfully without them. You alone can supply them. They are Care and Patience.

WITH summer comes a host of adversaries to attack your backyard garden that has booked so promising all spring. Chief of these are weeds and insect posts. How to get the best of them before they get the best of you, will be told in an early issue by Ernest Bade, Ph.D., who in the March issue offered valuable suggestions for spring

4

planting.

A Universal Radio Tuning Unit

How to Make a Combination Inductance for alwest Any Hook-Up

By Joseph Calcaterra
Radio Editor of Popular Science Monthly

IN EXPERIMENTS to develop a means of eliminating the usual waste of time, energy, and money in the construction of various types of radio tuning elements for use in the various types of hook-ups, the Popular Science Monthly radio laboratory has evolved the novel universal instrument pictured on this page Combining these varial characteristics of all the most commonly used inductive tuning sustients, it can be

adapted, withelight variations in arrangement, to the requirements of almost any type of standard radio receiving set

In addition, it embodies the simplest method of retor mounting yet devised, as well as the simplest way of mounting the colls to the base of the receiving set.

In this article I shall endeavor not only to describe how this unique combination unit is assembled, but to offer general suggestions for the construction of tuning elements that may be of assistance to the man who hallds his own receiving set

Referring to the illustrations on the page, Fig. 1 at the center is the

stator lend

new universal instrument, with three stators and two rotors combined to form a tuning element for use in powerful and selective receiving sets such as the three-circuit regenerative receiver. Here one rotor would be used for tuning the secondary, and the other rotor for tuning the plate circuit.

IN FIG. 2, rotor winding D and stator winding C have been removed, leaving a variocoupler with two windings on the stator and a rotor winding. This could be used in a circuit with winding A serving as the primary, B as the secondary, and E as the tickier coil. If desired, the rotor winding may be placed at the other end of the stator tube, so as to place it closer to the larger winding, A.

In Fig. 3, the unit is converted into a variometer. In this case, windings B and C are connected in series to form one continuous winding. One end of the stator winding then is connected with one of the rotor leads, leaving one rotor lead and one

In Fig. 4, the unit has become a dispersion type of tuning element, with concerning the context of the context

In Fig. 5, the two for windings are removed. The coil wild g C is fastened to the main stator for by means of the connecting link are we so that the axis of

imately 1 \(\) inches to the side of a line projected along the length of the coil from the rotor bearing. Thes will bring the taps within easy reach of the switch points with which they are to be connected

It is a good idea to have two sets of taps, one set on each side of the center line of the winding as shown in the photograph. The winding is started on the left-hand side of the cell about 1½ inches from the center line, as shown at 1. At a point about 1½ inches to the right of the center line, another tap is taken. The winding is continued for 10 turns and a tap taken

at a point at the left directly below the beginning of the winding. On the same turn, but to the right of the center line, another tap is taken.

This method is followed all the way down to the end of the winding. The last tap at the end of the winding is taken at the right-hand side of the center line, completing the two sets of taps, one on each side of the center line.

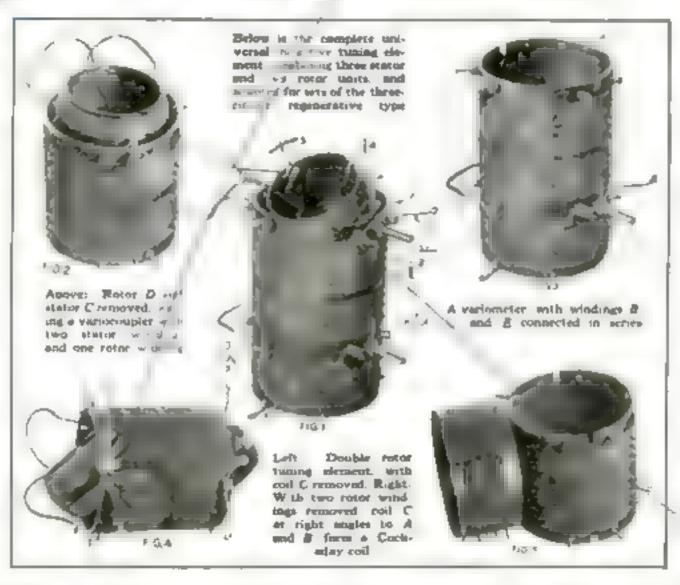
The advantage of this method lies in the fact that the switches can be used on either side, a very important consideration in experimental work.

For all general by seven and for a bay with a sere. I have found that 50 turns on the A

winding, 40 turns on the B winding, and 40 turns on the C winding, each tapped at every 10 turns, give best results. The rotor windings of B and E should have about 35 turns, although for various uses, other rotors with a larger or smaller number of turns can be substituted easily with the type of bearing used in the unit.

THE distance between windings A and B is one-quarter inch. To determine the length of tubes to use, it is necessary to know just how long the windings will be. This can be determined very easily when it is known that 33 turns of No. 22 a.c.c. or d.s.c. wire will make a winding length of one inch. If No. 20 wire of either insulation is used, approximately 26 turns will make one inch; while if a smaller size such as No. 24 is used, as many as 40 turns can be wound to the inch.

Since were is sold by the pound or fraction of a pound, it is necessary to know what weight of wire to ask for to make a Contensed on page 139)



coil C is at right angles to that of the other windings, and the unit serves as a Cockaday coil. It is necessary only to connect one turn of wire around coil A and connect this turn in series with coil C to serve as the primary coil of the circuit. Coil A forms the secondary coil winding, while coil B is used as the absorption circuit coil.

Many other combinations are possible with this unit. As you experiment with the coil, these will suggest themselves to you.

In constructing a tuning element, the manner in which you make the windings, the taps, rotor bearings and the other constructional details is extremely important to the ultimate success of the completed tuning element.

A four-inch tube is the best size to use for stator windings. The diameters of most of the standard rotors vary from 31 to 314 inches and can be used to best advantage with a tube of this size

The simplest and most efficient arrangement for the taps is a straight line, running the length of the coil and approx-

How to Select Your Radio Parts

RADIO set is no better than the poorest part n it!

This is as true as the fact that no chain is stronger than its weakest link. No matter how well a receiver may be deangued, constructed, and wired, it never will function satisfartorily if one defective part is

employed in it.

That is why the problem of selecting radio parts is one that norely perplaces not only the fan who builds his own receiver. but also the one who buys a factory-made product. questions I hear most frequently are, "Which are stan-dard parts?" 'What defects must I look out for?"

I am weing to try to answer these questions this month by pointing out the good points and the bad puints to be conndered in choosing various pieces of apparatus employed in a receiving set.

T THE outset we must A bear in mind that the actence of radio still is in a state of flux Commutertly there is no such thing as standardization at present, though acrious efforts are boing made by responsible organizations to develop a system of standard quality for the industry.

Let us take the receiving apparatus step by step, and consider what characteristics are necessary to insure maximum efficiency in operation First of all, the serial. This should be of copper wire Whether it is of single or multiple strand makes little difference, so long as it is copper The stranded wire will offer greater mechanical atrength

with less likelihood of brenkage under strain. The copper may be tinned to pre-

vent corresion from exposure.

The aerial is a very important part of the radio set, and unless it is correctly erected, maximum results are impossible. No matter what form the serial takes, it should be kept free of all kinks or bends. The straighter the wire, the better the results. It should be free of straggling ends, such as might result from you or three ruptured strands

If possible, keep the wire th one continuous piece from one end to the Joint where it is actually attached to the pecerying set. If a joint is necessary, he sure that it is well soldered to prevent resistance at the point of the joint. Remember that the amount of energy picked up by the serial is very small, and that it is unwise to loss any of it through the want of

a little care.

The type of strap "lead-ins" that have appeared recently abould not be used. These offer possibilities of too much leakage. A tube should be used. It should be of good insulating material, preferably

One Defective Unit Will Spoil the Best Hook-Up

By Jack Binns

America's Most Popular Writer on Radio



Careful examination of radio parts before purcheer judging them by the points outlined by Jock Benze in the accompanying article. will save trouble when the set is completed

porcelain, and it should be long enough to keep the wire clear of any other objects, metal or otherwise.

It E ground connection should regive best means, but restember that every jelbow' in the water-pipe system offers resistance to the high-frequency currents. It is best to run a ground wire down to the cellar, wherever possible, and make the connection with the pipe at a point just before it leaves the house. The pipe should be scraped clean with a file and a firm mechanical and electrical contact made with it. A ground clamp may be used, but it is a good plan to solder the connection in addition.

The actual parts to be used in the radio set are the next counderation. Whether it is better to buy a completed set, or construct one, always depends upon the individual and his skill with tools. The

points which I shall emphasize will serve as a guide in either

First of all are the various forms of inductances. These always are cods, although they may take many different forms. They may consist of variocouplers, variameters, or duointerni and honeycomb coils. The important consideration in all inductances is the amount of dutributed capacity in the windings. This always should be at the minimum. The duolateral-wound cor, is an example of low distributed capacity in a coil, due to the particular form of winding.

IN A variocoupler such wind-ing is impossible. The point to watch for in this instrument in the use of sticky material to hold the coils together. None should be used. Double-covered wires necessarily must be used, but it is not necessary to dops them. The single-turn tape on the autistic coil should be so arranged that they run diagonally across the coil, thus preventing abort-circusting of the turns at the points where the tape are made variable condensers are employed in conjunction with the primary winding of a variocoupler, individual tapping of the turns is unnecessary

In the rotor coil of a variocoupler, flexible connections to binding-posts should be widely separated from each other This means, of course, that the rotor should move around only 180 degrees. Do not consider couplers where the rotor connections are made to the shaft on which the coil revolves. Thu involves a friction contact

that always introduces resustance into the radio-frequency side of the circuit.

The insulating material on which the colls of the coupler are wound, should be as thin as possible consistent with mechan-ical strength. In other words, too much moded naterial is detrimental to maxithe same care should be readers of choosing variometers. Pigtall sexuble wire) connections are necessary between the rotor and stator rolls, and while it is necessary to have a certain amoust of "dope" on the coils to hold them Rogether, the least possible amount should be used. Collodion is the best material. The smaller the amount of insulating material in the forms holding the coils, the better the variometer

Remember that in both variocouplers and variometers the wave-length range will depend entirely upon the amount of inductance in them. The inductance, in turn, depends upon the size of the wire used, and the number of turns employed. The wire should be no smaller to gage than No. 30. A larger diameter wire will

give better results.

The ideal variable condenser still remains to be produced. In no other instrument is there so much loss. The most efficient type is one with a minimum of insulating material between the rotor and stator plates. Here the stationary plates are fastened to narrow strips of special hard rubber, which are well away from the rotor plates. The latter are part of the main frame of the condenser, and they have a flexible connection with a binding post acrowed directly into the metal frame. The condenser is fitted with stops so that more than 180 degrees of movement is impossible.

MOST variable condensers at present simpley aluminum plates, but unfortunately it is very difficult to get also lutely positive electrical connections with aluminum. Brass plates are better that they should be very thick to that they should be very thick to that they aloud be soldered together both in the rotor set and the stationary set. A separate Vernier plate always to had, because losses are introduced if the hearings. It is much better to employ some good form of Vernier attachment on the dial controlling the sendenser.

Fixed condequers appear to be simple little instruments, yet in them lucks all kinds of trouble; unless they are accurated with the greatest possible late.

Under no endumentances should a most condenser employ paper as the diese tre. This type of condenser is cheapty to see as a rule, and the paper and foil are wound around a place of fiber. The capacity of such an instrument is changing constantly because of varying conditions around it. This is because the pressure

between the foil and paper is not constant—a defect that may be responsible for many notes in a set. Placing a paper condenser in any part of the circuit where it crosses a highvoltage B battery is a dangerous practice.

The ideal fixed condenser is one using a dielectric of mica, and held between two covers that have been forced together under extreme pressure, and finally scaled off, so that a variation in the pressure is impossible. Only in this manner can constant capacity be se-

sured.

In choosing sockets, make sure that the springs are sturd) and will not bend. Steel cannot be used for the springs, but good phosphor-bronze will serve well. The hinding-posts to the springs should be separated as far as possible, and the socket should have as little insulating material as possible in order to reduce capacity losses.

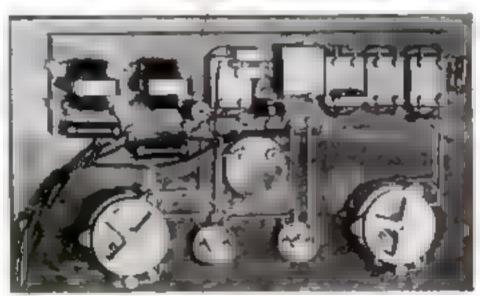
Rhecetats are very important instruments. They not only regulate the voltage and current flow to the filaments of

the vacuum tubes, but they also dissipate heat. If they are overloaded that is, if too many tubes are run off one rheostat—the wires will heat up dangerously. The resistance wires should be wound on heat-resisting fiber, and should be arranged so that they offer a good surface for radiating

the heat. The contact arm that passes over the resistance wires should rest firmly on the wire at every possible setting. Unless it does, an arc will be formed at the point of contact, burning out the rheostat

The selection of transformers offers a very deficult problem indeed. Little can be said about rat o-frequency amplifying transforment, because their results are so problematical recept in the most carefully studied circuits. In my opinion they are not the meal form for radio reception. Nestandard can be set as a guide in their burchase. Any radio transformer for which is weeping chains are made as to wave-length range should be shouned

In audio-frequency transformers a similar condition prevails. But here a



The Latest Development in Radio

MAJOR EDWIN R ARMSTRONG, pioneer radio inventor in seven in the upper perture demonstrating the last word in radio development has newly designed receiver known as a "second harmonic regenoflex super heterodyne." The layout of parts of the new receiver appears in the lower picture.

Major Armstrong describes his set as depending not alone on reduc-frequency amplification, audio amplification or regeneration but makes use of a third frequency knowle as "intermediate frequency. This is said to be higher than audio frequency and lower than radio frequency as used in present receivers. The combined use of the three frequencies is said to give an over-all amplification of great magnitude making the ori catternely sensitive. Radiation is eliminated by use of a spocial muffler tube circuit. Set tubes of the UV 199 type are used to operation

very good guide is the step-up ratio of the transformer. This should not exceed five to one. A three-to-one ratio transformer, well constructed, will give all the amplification necessary for good results without possibility of distortion or the setting up of audio-frequency howls.

The iron core of the transformer is an important part of the instrument. It should consist of fairly thin-gage soft-iron faminations, arranged in a completely closed magnetic circuit. The binding-posts with which connections are made should be well insulated, and it is a good plan to test the transformer for continuity of the primary and secondary windings before purchasing. Be sure, too, that neither of the two windings is short circuited to the iron core.

Probably there is no more simple piece of apparatus in a radio set than the grid leak, yet nothing can wreck a receiver more quickly than an imperfect leak. If a variable leak is used—and there are many advantages to such a leak it should give an even variation in resistance over its entire scale. In the compression type of leak, be careful that the material that is put under pressure to reduce the resistance is not loose, otherwise the reception always will be nolsy

ANOTHER method of varying the grid input circuit of a detector tube is the employment of a variable condensar of the compact mica type. In this case a fixed grid leak can be used, but it is always best to experiment with different values of fixed grid leak, to select the one best suited to the particular tube. The variable grid condenser, if it is of the mica type, should be constructed firmly. Looseness in the movable part always will cause meses in the set.

Of the nuxiliary apparatus used in a receiver, there is no more useful part than the jack. With it various circuit combinations can be obtained in a second without charging any wirm or interfering with the

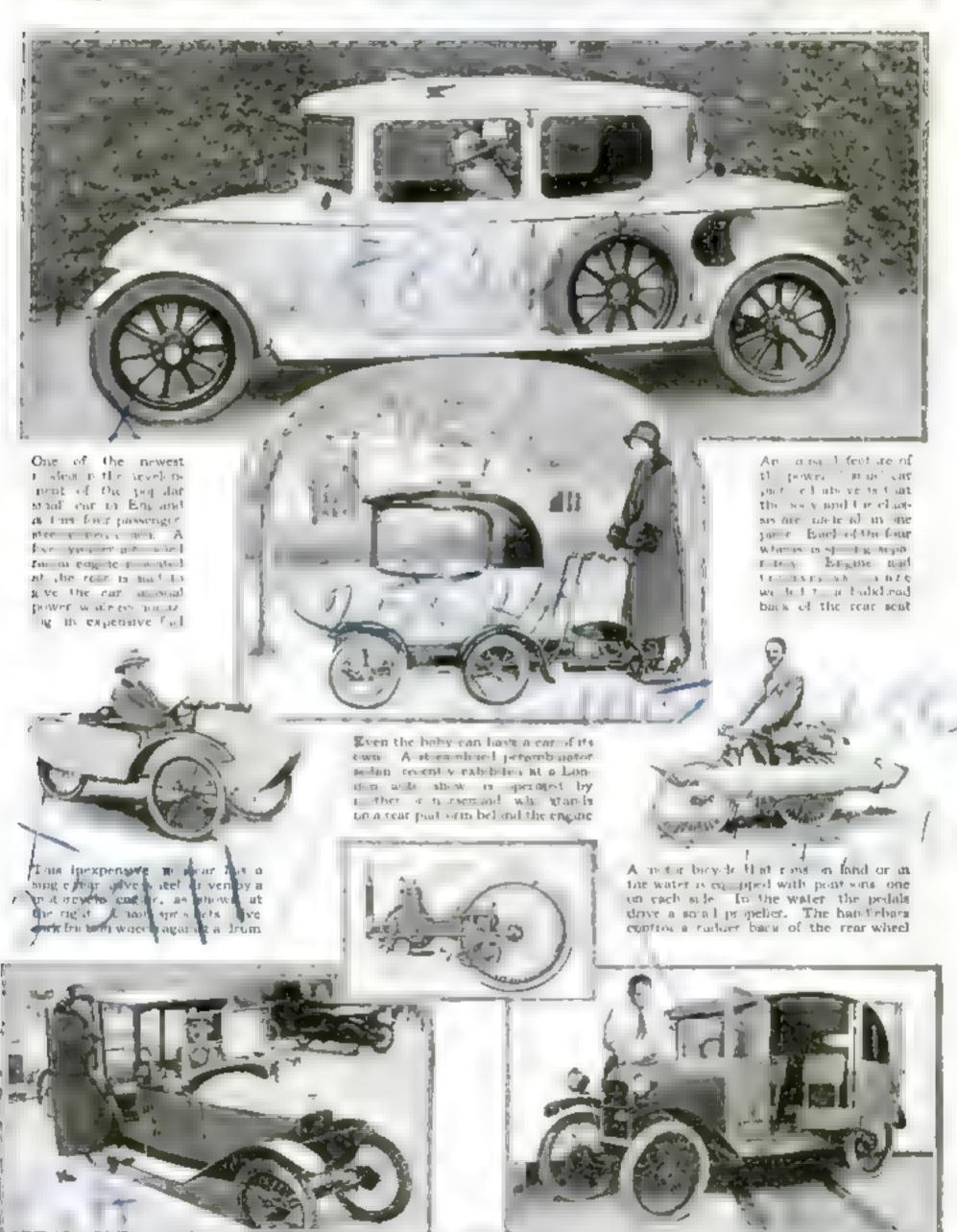
act. There are many different kinds of jacks, however, and imperfect ones may be responsible for many radio ills.

The main thing to look for in a jack is the quality of the contacting springs, which should be strengthened by shorter spring leaves. In addition, in the multi-circuit type, be sure there is perfect positive contact between the springs when the telephone plug is pulled out. Since large voltages will be placed in the jack circuits, the contact points should be fairly large.

The value of a telephone plug can be judged by closs examination. See that the insulation material surrounding the plug is strong. The internal arrangement should be such that the telephone tips are firmly gripped in whatever manner they are engaged. The central rod inside the outer alseve of the plug should be well insulated throughout the length of the plug, as well as at the point where it enters the handle.

NEXT month—"Radio by the Roadvide." Jack Binns will tell how to get the most radio enjoyment during your summer auto-camping trip. His unusual article will give useful pointers for successful reception out of doors, such as favorable locations, erection of an aerial, and choice of a receiver.

The Latest Oddities in Motor Cars



A number of toxical operators in Paris seeining to economize have an opted the sturily little tax shown above to accommonate the many single-passenger fares

Legamously uphoistered in French tapestry, this seven harser ower 850 pound boby sedan is a copin a of a high powered and much more exposure knowsine

Look to Your Steering-Gear!

The Most Vital Point of Your Car Is the Most Neglected

By F. A. Platte
Department of Physics,
Columbia University

OST motorists have experienced the feeling of helplessness that comes when a car skids suddenly on a slippery pavement. But there is another way in which your car may get put of control that contains more dangerous possibilities than skidding. That is to have your steering mechanism go wrong while you are driving. Imagine yourself proceeding at 85 or 40 miles an hour along a narrow road flanked by a ditch or

a wall of rock and consider what might happen were you suddenly unable to steer your car!

And yet I venture to say that the steering mechanism, despite its obvious importance, is the last unit in your car to which you think of giving care and attention.

ON A motor car the axle is immovably attached to the chamis, and the wheels are pivoted to the ends in such a way that each can be swung to right or left in the following manner:

When you turn the steering-wheel you revolve a shaft known as the 'ateering column." At the bottom of this in most types of car is a worm gear. This turns a gear wheel that moves the "steering arms." The

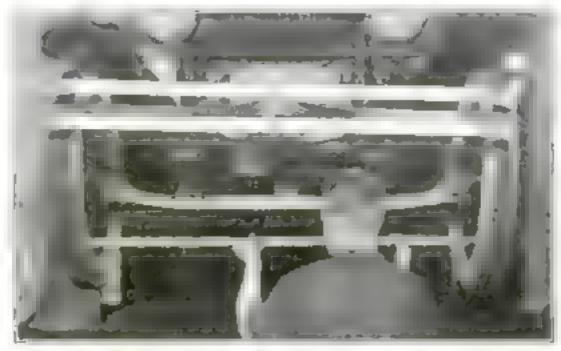
arms are connected with the pivoted ends of the axie, which are called the "steering knuckles." These are connected by a cross piece called the "tle rod," and when this is moved from side to side, the wheat turn to right or left.

Each part represents a separate and distinct point when the steering mechanism can get out of order. For examp n if a steering arm breaks, or becomes disconnected from the terroit, one wheel may swing sidewise and cause the car to go off the road.

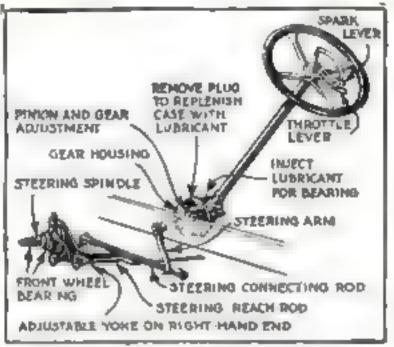
swing sidewise and cause the car to go off the road. A similar break may cause both wheels to swing loose on their pivots.

You can insure your car against this sort of accident by a little intelligent care. The most important consideration probably is lubrication. The tie rod and the steering-rod should be inspected and ciled thoroughly every hundred triles. When you are oiling them, look carefully for loose nuts or cotter-pins.

The steering column likewise requires frequent lubrication. It is well to oil the steering mechanism thor-



Measuring the "ten in" of the front wheels to cours correct alinement



This diagram shows important parts of the staging our bassam that should be lubricated impossity

oughly, wherever the steering becomes especially hard. In all likelihood it will be found that it is due to wdry joint somewhere

The front wheel of an automobile are how-egged and pigeon tood in other words, the wheels are not set parallel. They are about a quarter of an inch closer together at the front than at the rear and

the bottoms are from a balf inch to three inches closer together than the tops. The wheels are made to toe in to compensate for a tendency to turn out in front when the car is proceeding at good speed,

As the car is used, the tie rod wears and the toe-in becomes wider. Finally the wheels begin to wabble. Wear on the tie rod can be reduced to a minimum by frequent lubrication. This is important, since misalinement of the wheels makes steering difficult, causes danger, and is very hard on tires. The wheels may

be alined properly with reference to toe-in by adjusting the tie rod.

It is well to test the alinement occasionally. To do this, jack up the front of the ear, turn each wheel and, while it revolves, hold a pencil supported on a block against the center of the tire. This will make a mark clear around each wheel. Then let the ear down and measure the distance between the pencil lines in front and in rear. Auto mechanics often use a special adjustable measuring-rod for the purpose. The difference between the measurements will determine the adjustments.

ON MOST cars the tie rod screws into a yoke at either end. By unbolting the yoke and scrawing it off one or two threads, you will com-

pensate for wear and restore the original toe-in.

The gear wheel turned by the worm in the steering column likewise requires occasional attention. Even when you turn the steering-wheel as far as it will revolve, the worm will engage only three teeth in this gear, and the result is that the gear will be worn excessively at one or two points. You should inspect the gear at intervals and, if a few teeth

show signs of wear, the gear wheel should be turned so that a new set of teeth will come in contact with the worm

These adjustments the average car-owner can make himself. A motorist's time cannot be employed to better advantage than in keeping the steering mechanism in order; for if the steering gear goes bad, the consequences are almost certain to be serious.

IN NEXT month's issue

-the most interesting
and unusual automobile
camping story ever pubhehed. Don't muss it!

Know Your Car

Here are the most common tire troubles, their causes, and the remedies:

Sand Blister - Dirt works through a hole and under tread. Inspect time often and repair all small cuts.

Worn Tread—Wheels out of line; sliding tire; driving in car tracks. Adjust the steering knuckle. Don't jam brakes.

Chafed Tires -Scraping against curbs: driving in ruts and car tracks. Use shock absorbers on rough roads. Avoid ruts.

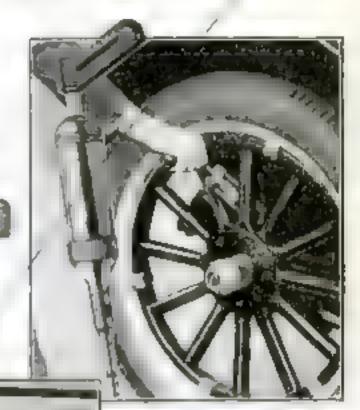
Cut Tread Class, nails, and sharp stones. Inspect turn often.
Watch the road for glass. Coment cuts wherever the overed.

Rim Cuts—Running on flat tire and skidding. Curry a spare true. Keep tires well inflated. Take corners slowly

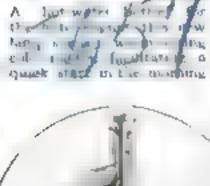
New Accessories for the Autoist

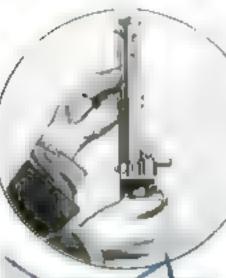


replace west I damage tours to it a expense to will to new fulle copy to the embing capacity is claimed Lattue appears spiral core construction



Pressure of all pounds a this h brighting trense g in P adding the Jamelle i area the abound of an needed

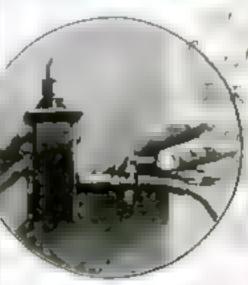




a motoridan gr garge bound until whitevery a grant of authority distri-cal be flow which on a one palides not se took The



During a long trid one problem of a find on the fithe way part to the bar a secretary above a compactate material as need. The critical the bar as inverted in a part ring to t presses the bring out against the car shot

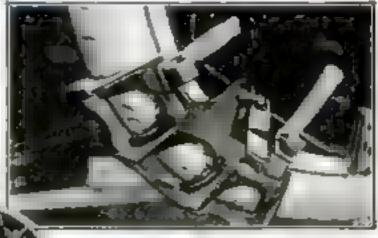


South plant can be charted wate this new comparated? air sevice that blows meanest with a cleanwing liquid



The m vantage of this natural hits confirm a bout I have per ex as a send support when a tire is to be thank It is feed and to split the recastle or receive a task that he may is per former on the ground where harreful dirt may set also the tire and on the tube

Designed to clean out the degree oil line quarkly the attachiomit shows below consists of a peterck cast on a sprein bracket a gasket and a Bear to salve ling enough to reach the uph the bne in the crankcase of the engine



The cleaner is bolted on and a small help a drilled through the meet bette of the cranktage

Another seful type if the carrier collects of two supporting units that may be re even I from the reat of the car and used as mud hoeks as always shows Barti a me is eq appea with a lune or parter amount to printect the (car amortur tere against theft. The device as especially used ful to carry on trips over uncertain coads

Automobile Ideas that Save Money

ORE miles a gallon!" is the cry of every motorist. An enterent gas saver can be made in the home workshop, as shows in Fig 1 The ntake man fold is drilled and tapped for a carburetar elbow. A perion of pipe is ied from this to the duch, where it is fastened to a tel driveneck such as was used a old Ford carousters. The cont should be packed and soldered to make it

mechaniculty and thoroughly a great the meetle valve, air can be admitted to the intake manifold, where it can mix with the explosive mixture from the carbureter When the engine is warm, there is no need of the rich mixture required for starting, so the motorist can open this air valve at any time without leaving his seat.

AN OLD headamp can be made to samet greatly in illumi nating the interiors of motors Hudergorak renight. The mp la bourd (Fig 2) and the lens is covered with a wire screen to prevent tools from breaking it. A screwsys placed in one end of the board allows it to be hung e up on the wall or instened to any convenient part of the engine.

WITH a ber

other wheel. This is a marked on

ONE of the appropriate encountered when overhabling a motor is the falling down of things while placed the capton the connecting rod. This can be

remedied by using two crinkly hairpins to hold the shims on the bolt, as shown in

THE positive terminal of storage battery very atten correct II it is not kept and intreased, range in me the connects processes to make a new tale the trinial, a temporary repair can be made by driving a wire nail between the post

WHEN filling the radiator, is frequently or report popular is musplaced, broken, or tal Apon the Amninga hoof of Jen, steel rod to this up, as shown in Fig 7, the cap can be unacrowed and hung over the opening during the process of filling the radiator.

LIALVE noises can biten be reduced by altering the a pe of the valve at

where it bears on the tappet By e c > thus end $\mu \in \mathbb{N} + \mathbb{R}$ of a but of the fe Fy. be there easily a meet

and maintained

O SIPHON graso line out of a barrel, use a rubber hose that will not bend too enaily. Have one about the size ordinarily used on a

small foot spraypump. The hose should be 230 (t

leng.

Put one end down in the gasoline bazzet and hold the piher and in the hand with the ball of the thumb over the end (Fig. 9). Now, with a quick jerk, bring up the hose about 6 in., removing the thumb, and as quickry shove it down 6 in., again putting the thumb over the end Repeal thus operation until the gasoline starts, then quickly drop the



Fig. 6. Woll tighteen

FUOLINGUIGH

Pig. 1. Powerful

light for repairs

Fig. 8 Valve steen

to me and of the tube into the receptacie at at will siphon out the gasoline.

BROKEN springe in pumenger-cars and when precautions have been taken to tighten the retaining clips. The nuts to the sprink clips may be pulled up fairly tight, yet the spring leaves may not be solidly to be to prevent The better method of tightening the apring clips is to do this when the car or 'the has loaded. Test this out by tighting the the chips and then loading.

APART from remain me the distilled water in the battery of a the operation of the car is a conspicuous factor in maintaining the battery charge.

An engine with clean apara-plugs and a carbureter so adjusted that the second or third turn causes it to start a essentia. to a battery that as to be kept charged

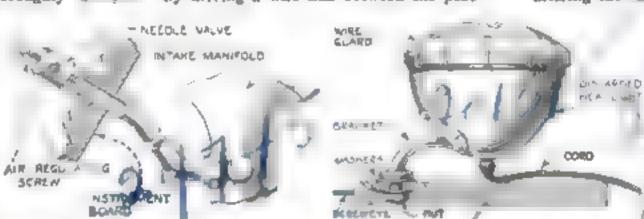


Fig. 1 Desh edjustment for air



Pig. 4. Molding shime with heterone



Fig. 7 Radiator cap.

such its 6 rake handle and two ordinary shelf brackets, a wheel liner for testing the almement of the front wheels can be quickly made. The long ends of the brackets are bent outward at right angles so that they can be looked to the spokes. One bracket is scienced tightly to one end of the bar, but the other is left off. The bent arm of the stanonary bracket is placed on the forward end of a wheel spoke, as shown in Fig. 9, and the other is reloyed out on the bar until it bears print the corresponding on the the bar. The distance between the rear of the wheels is then measured in the same way Any difference in the measurements indicates wheel musimement, which should be corrected.



Fig. 3. Biompio tenter for altrang-dringly



Fig 8. Chasply made padal atend

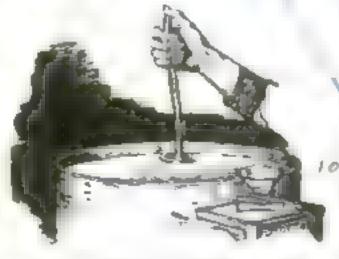


Fig. 9. "Primping" to start flow of gaspine

and terminal in the manner shown in

ON MOST care there is no way in which the pedals can be adjusted to conform to the length of the deiver's limbs. This adjustment can be pade by bolting a bent pleas of lawn, swel plate to the pedal as above in Fig. 6. The beight of the extension is determined by trustment the top is roughened or checkered. to prevent the foot from slipping.



Home Workshop

Arthur Wakeling, Editor

How to Build Ornamental Trellis-Work

RNAMENTAL tre.lis-work affords a happy solution for the home worker who wishes to use the lengthening daylight of spring evenings to improve the appearance of his house and garden He very easily can take a leaf out of the notebook of architects, who often use well-designed and carefully placed trellises to give an added touch of beauty to already finely proportioned residences.

In these days of high building costs the majority of houses are necessarily made as plain and box-like as possible, and there is not a great deal the owners can do to improve their appearance except to keep them well painted, and to add such features as the flower boxes described in last month's Home Workshop Department and trellises such as those illustrated on this page.

Several types of construction are shown and these designs, which were developed by George F. Kaercher especially for the Home Workshop series of blueprints, may be modified or combined in endless ways.

THE design below is used flat against the wall of a building and often will redeem miraculously an otherwise unattractive and perhaps poorty balanced facade.

More elaborate than this and especially effective with houses of the long, narrow type, is the trulis acreen and garden gate litustrated in Fig. 2. This is designed to extend from the wall of a house, dividing the flower garden from the laundry or service yard. It could be used also to separate a formal from an old-fashioned garden or a flower garden from the children's play-yard, or for similar purposes.

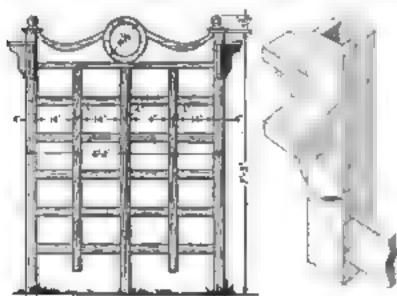


Fig. 1 An exchitectural trellis used against a house wall, and detail, explaining construction, of the pests



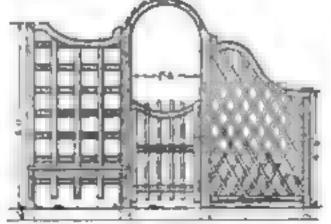


Fig. 2. Design for a trellie wreen, detailed in fall on Home Workshop Slurprint No. 34

The view in the lower part of Fig. 2 really above two designs combined to cave space; both sides ordinarily are made alike, as in the upper drawing, but the combination also is effective and has ad-

vantages in certain locations where the informal, steplike profile of the top harmonizes with other features of architecture or landscape.

Figure 3 shows a simplified construction of the familiar fan trellis now enjoying renewed popularity. It can be used as a full spread fan, as a half fan at a corner, or as a double corner ornament, half the spread being on one wall and half on the adjacent wall.

The fourth suggestion (Fig. 2, above, and Fig. 6, page 122) is a simple trellis-work sun-dial, which, while a garden ornament pure and simple, is especially suited for use in conjunction with

other trellises, artiors, or pergolas.

Elaborate as these trellises appear when finished, their construction is surprisingly easy and well within the ability of any man handy with woodworking tools. And the construction is sturdy enough to insure the trellises' lasting for years, and not falling apart as sometimes in the case with flunsy and hastily built woodwork of this kind. For durability, typicas, white pine, or other weather-resisting wood should be used

The treils in Fig. 1 is supported by two boxists posts, which project 18 in, into the ground and extend 7 ft. 9 in, above. They are 6 ft. 2 in, apart from outside to outside. Each post consists of a back and front face stile 1/4 by 4 in, by 9 ft. 8 in., and an inside filling piece 1/4 by 1 1/4 by 9 ft.

3 in. Before the front face is upiled on, the inside filling piece, as shown at the right of Fig. 1, is builed to the back still and then the cross members or rails are sailed to the filling piece. The gaps between the rails are filled with short filling pieces, 1/2 by 1/2 by 10 in., and the face stile then can be nailed on. In this way, it will be seen that all the usual difficulties of notching or fitting are avoided.

THE center muntin or upright division is 1/4 by 4 in. by 8 ft. and the two shorter side muntins or divisions are 1/4 by 8 in. by 6 ft. The 5 rails are 3/4 by 8 in. by 9 ft. 9 in., the straight cap across the top is 11/4 by 4 in. by 5 ft. 6 in., the post caps are 11/4 by 5 by 7 in., and the post ornaments are 13/4 by 4 by 5 in.

The central circle is 2-ply, being built up of cemicircles cut from 6 pieces 34 by

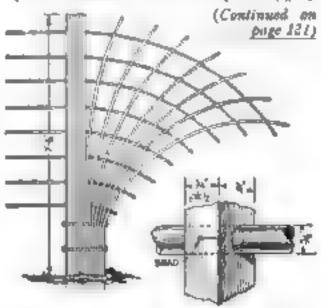


Fig. 3. A simple fan trellis showing how the bers are first builted together and spread

Speedy Toy Motorboat Built from Old Crate

10 BUILD a moder motorboat from I to 2 ft. long with a spring-motor drive is not difficult. Little more is needed than a knife, a saw, a hammer, a few small, thin nails, an empty egg crate, and a spring motor salvaged from an old (

Take off the thin sides of the cratt and soak them thoroughly in pater fel at least 12 hours. In the meantime construct the keel, ribs, sterningd prow from the thicker end places of the hox.

The keel is about in high and as long as the model is to be. The even is a narrow tapeling to be wood about 2 in. wide at the top and slanting inward to the thickness of the keel at the bottom. The prow is either a straight piece of wood the thickness of the keel, or it is slightly curved. Both prow and storn are named firmly to the keel

The two ribs are, in reality, two pieces of the thicker wood cut 2 or S in, wider at the top than the stern. These also are attached to the keel and divide the boat into

three parts, as shown in the illustration. One of the thin watersoaked boards can

now he nailed in place. One end is fit between the board and ribs. Do not fastened to the stern and a long edge is named gong the keel. Then the board in

alping pers are carefully cut away with a sharp knufe. Sometimes. when the board is bent, it does not



lat Jeft

The toy b o n t eflost inbave) atted luft and from the water for winding

force the thin wood or bend it too violently toward the top of the ribs. When dry, the bost is painted with white lead or other

The motor can be the spring drive of an old toy locomotive, if the spring and the gears are in good condition. Take out the spring as a whole and mount in the boat on a block. Attach

a small gear wheel to the drive shaft and a corresponding pinion or smaller gear to the shaft carrying the propeller. The gear and pinion can be obtained in any large department or toy store, as they are sold as additional parts for toy construction sets.

The propeller, made from a piece of sheet tin or zinc, is attached to the shaft with solder or by two collars and set-

serews.

A rudder completes the boat except for the cabin, must, and other refinements, which may be added to suit the tests of the builder. - E B

Simple Repair Tricks that Triple the Life of a Canoe

reach the top of the ribe amidakips.

This can be fixed by cutting strips to

X 71TH proper care a canvas-covered cance should last 25 years. This may appear questionable to any one who has discarded one of sheep light graft after a few years of service because it leaked. The writer however, knows whereof he writes, as in still has to service a "leaky" cance that was throws

When it came into the writer's possession, the light S/14 in. collar planking was dry and cracked in so mene places that the bottom would give when stepped on while the calroe was in the water. An inapertion showed that water was coming in through half a dozen holes, which apparently fact been made by stones or snags.

ASTHE nuter coating of paint was badly cracked, the first step was to remove all paint and enamel with a paste of soup powder and hot water. This mixture was ameared on 16 in, thick and allowed to remain overnight. With the aid of an old hunting-knife the paint was accuped off easily. The filter in the canvas next was attacked with a scrubbing brush and bot water and the canvas scrubbed until the outer surface was clean and white.

After the canvas had dried for a day or two, all the holes were located and sealed. Right here is the secret of the process. The sealing is done—not with cance "dope" sold for the purpose—but with

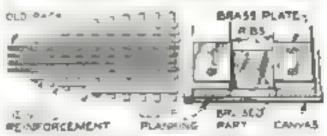
hard or flake shellar

A small quantity first is sprinkled over the canvan and a hot soldering iron is used to melt and rub it in. Do not have the iron nearly as hot as for soldering, and stop work for a moment if the shellse starts to bubble. When a hole is completely filled, allow it to cool and pure off most of the surplus with a sharp knife

Next, sand down the spot level with the surface of the canvas, using No. 2 sand-

paper wrapped around a small block of and hale now is sealed with a and est sufficiently elected to and get sufficiently elastic to





Method of senting holes with hot sheller and repearing planking and floor rack

prevent cracking; in fact, the patch is stronger than the canvas steelf.

Proceed in a similar manner with all the remaining holes. If one of them happens to be an extra long slit or a three-cornered tear, tuck a small piece of cotton drill under the canvas at this point and run in as much of the melted shellac as possible without producing too much of a buige.

The next operation is to refill the canwas with a coat of yellow others. About 114 lb. dry powder is required for a 17foot canon. It should be mixed with boiled linseed oil and a small quantity of turpentine. The consistency of the mixture should be somewhat thicker than

that of ordinary paint.

This coat should dry in about a week, while the inside of the cance is being renovated. Over every spongy or badly cracked spot should be placed a brass plate 3/32 in, thick, as shown in the diagram. If the bottom seems weak, the regular rack should be enlarged, as indicated in the diagram. The wide pieces are nailed with bram nails so they come between each rib of the cance. The long slats also are increased in number so that the whole buttom is protected. It is necessary to remove the thwarts when placing this rack in position.

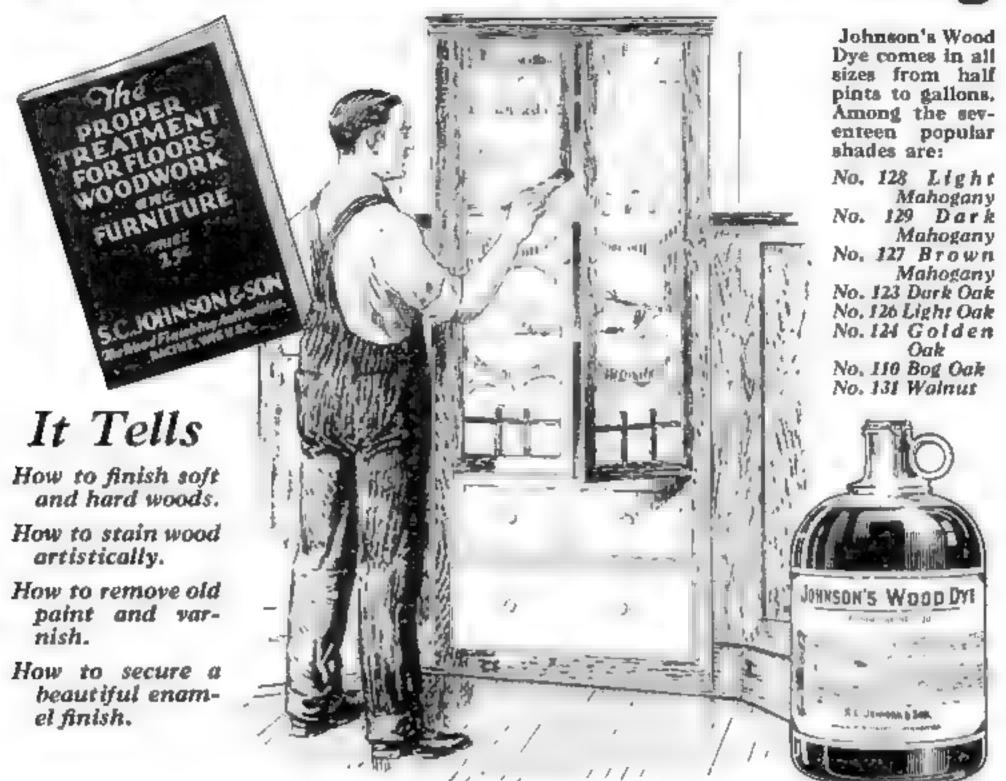
WHEN the other filling is hard, sand it with No. 2 sandpaper and lay on a coat of coach paint or, if preferred, one of the so-called cance enamels, which are very satisfactory but expensive. Coach paint is a perfectly flat color that should be mixed only with turpentine so that it dries very quickly. The best surface finish over the color is spar varnish, three coats being put on about 40 hours apart.

The inside of the canoe usually cannot be made to look like new, but it can be greatly improved by a careful acrubbing with soap and water followed by two coats of light oak varnish stain after the surface

is thoroughly dry.

If reasonable care has been exercised and the painting and varnishing done under cover and where there is little dust, the result will be a canon nearly as good as new. If a new hole appears at any time, repair it by the shellac and hot fron method. E. E. Scott.

FREE—Book on Wood Finishing



If you have a hobby for making cabinets, furniture, porch swings—radio boxes, etc., you will find our Book invaluable. Naturally, you want to give your handiwork a beautiful finish. Our Book gives complete instructions for finishing all wood-hard or soft, old or new. It is the work of experts—beautifully illustrated in color. Gives covering capacities-includes color charts, etc. Use coupon below.

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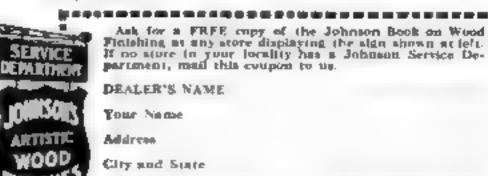
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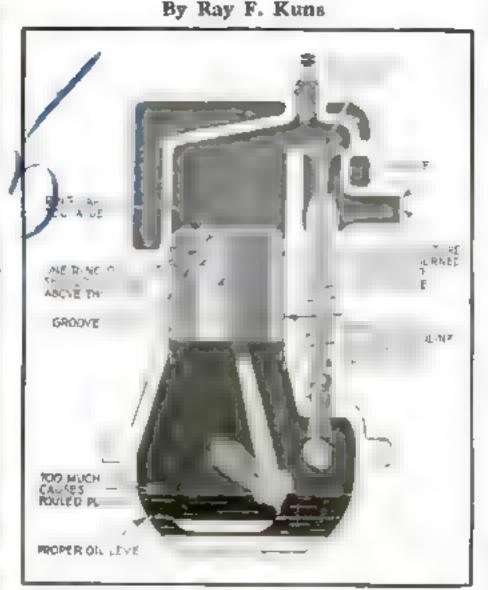
Making Your Spark Plugs Last 28,000 Miles

Is your auto tuned up to top-notch afficiency? If it ian't and you have any of those annoying little musadventures that fall to the lot of so many motorists, you will find a vast amount of helpful information in this and following articles of a noteworthy series by Ray F Kuns, principal of the Public Automotive Trade School, of Cinginnati, Ohio.

AYBE I wasn't mid" sa d a motoriet to me the other day that set of plugs in we for 28 000 miles, and when allowed not boy to clean out the carbon, he broke one of shedorwinal plugs, and I have And to put in a new one. I was proud of that set of pluga. Do you know, I never cleaned those plugs but once, and that was after I got out of the hospital Every one had been driving the car, and it termed to be in terrible condition I took out the place, and they were choked with oil and cashon. The folks must have kept the carburetor choked al the time, and pumped the cylinders full of oil and gas."

This owner went on to tell me that he had cleaned the plugs roughly, had the old oil drained and the proper amount of oil

placed in the crankcase, shut down the gas mixture to the proper point, and shortly all the plugs were burned clean again without further attention.



This chart shows at a glance the most frequent causes for carboncosted, oil-covered spark plugs, the plugs themselves are recely to blame

A physician can gage the condition of a patient by the condition or coeffing of the tongue. The car owner and mechanic can gage the condition of the angine by the contings on the spark plugs. A coating of oil may mean bad rings, sloppy pistons, scored cylinders, poor oil, too much oil, and similar shortcomings. Scoty, fouled pluge may mean too rich a musture. Clean brown or tan porcelains mean a good mixture burned in an engine that is performing well,

Since the plug appearance is an index of condition of the engine, it is well to heed its warming, and instead of trying to make the engine right by cleaning the plug, make the engine

stack right

Plugs do not fall along with other engine parts. The life of a good plug is measured in tens of thousands of mules. Where a plug ecems to be bad, move it from cylinder to cylinder of the engine. Only if the trouble moves with the plug, should it be discarded. If the trouble remains in one cylinder and succossive plugs fail to fire properly, the parts belonging to that cylinder must be made right.

After plugs have given service for a long term and one is broken, it is well to replace all. Take care of the new set by keeping spark, mixture, oil, and com-pression right. Then there will be no need to be changing them.

daily and tinkering with them continually, and you, too, will regret when after two orwibree years' service, one is inadvertently broken.

Ornamental Giraffe Upholds Ashtray

THIS unique amoking stand affords an opportunity for the man who likes to make things with tools is exercise his skill and ingenuity

It is best to make the parts of hardwood; the work is more diffiguit, but a lasting job is assured. The tigure site is be cut from a board so that the grad runs vertically. A turning way may be used, if at hand, but a company haw will do the work quite quickly.

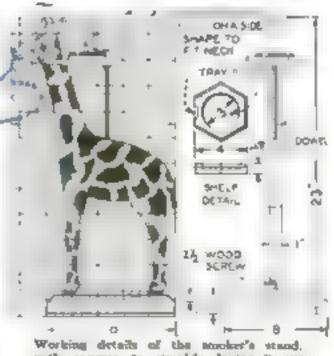
The base which is Tig by 8 by 10 km., has per in Champfer around the top edges. The figure is fastened to the base with 2 2 q ma bright flat head screws, set into

the name 16 in.

The tray shelf is cut from at-in stock, 6 in. square. Lay out a 4-in. circle and scribe a hexagon outside of the circle. Saw this out, plane the edges smooth, and plane a 14-in, chamfer on five of the top edges.

A circular hole is next cut in the top side of the shelf to suit the ashtray to be used. The hole should be as large as the ashtray in diameter and should be deep enough to prevent the tray from sliding off. On the sixth side, which has not been chamfered, cut a recess to fit the neck of the giraffe. Also bore a \$5-in. hole 1/4 in. deep on the bottom of the shelf, as shown.

Fit the shell to the giraffe and locate the spot where the dowel support will rest on its back; then bore a 🎠 in. hole 🦎 in. deep. Glue the dowel support to the



with equares to simplify laying it our.

figure and to the shelf. Two No. 16 2-in. brada should be driven through the neck of the giraffe into the shelf below the bottom of the opening for the tray. Then, to strengthen the job further, fasten a thin piece of copper or brase around the neck of the figure and nail both ends.

To make the stand realistic, the giraffe is painted a neutral yellow. Black is used for the outline and the apots, and the base and shelf are also enameled black .-KENNETH R. LA VOY, New Rochelle, N Y.

How to Re-Thread Worn Nuts and Screws

"HE threads of a screw or nut, or both, belonging to some sesential equipment sometimes become stripped and the whole machine is made useless. The particular screw or nut may be an add size, perhaps with an irregular lead, and no tap or die at band will suit it.

In case a nut has failed, as is more often the case, make a tap out of the fired screw by fluting the first few throads within for, then harden this portion by believe it and quenching in water in brine. If the acrew is meanly markinery specior refined iron, hear the arrest and animers it in cyanide of potassium, treating it with two on these heatings. Then heat it to a bright red and quench it in brine.

Thereat is then acreesed together as all.

The hut is then squeezed together on all aids in a vise and forced over the improvised tap. By this means I have repaired surgical instruments with metric threads. bicycle parts, lawnmower parts, and a

variety of home implements.

When the nut is in good condition, it may be fluted and hardened to serve as a die. Usually there is sufficient stock unthreaded on the bolt to allow new threads to be cut. It is best afterward to soften the part that has been hardened so that it will not break when replaced in the machine or implement to which it belongs.-O. S. Marshall, Springfield, Vt.

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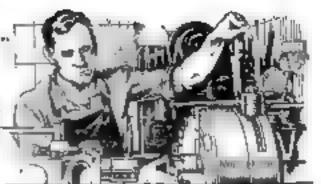
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Better Shop Methods

How Expert Mechanics Save Time and Labor



Die-Making Simplified for Every Machinist

By S. A. McDonald

Poreman Die-Designer and Expert on Punch Press Practice

bave some misgivings when confronted with a punch-and-die job, as to his ability to do the fine work he seen the experienced die-maker perform. He may not realize that a first-class machinist does just as fine work, using the same machines, tools, and measuring instruments, as the die-maker. It is only that he lacks experience in this line of work.

There are a number of outstanding features in the making of punches and dies that every machinist should know. These, added to the experience he has in his own line, should make it possible for him to handle the average punch-and-die job.

To bring out some of these points clearly, let us take the blanking die for the simple blank shown in Fig. 1 and carry it through to completion.

In some shope it is the custom to design the dies in the drafting department, and the machinist or die-maker is given a fully dimensioned drawing. This simplifies the work, and where there is a jet of die work, it is a good policy. In the simple or sketch of the pleed, and the die-maker has to design and make the punch and die.

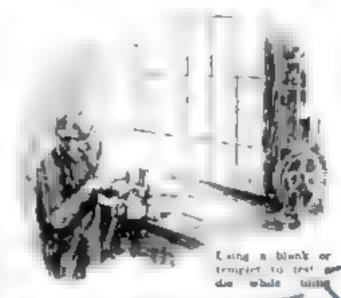
If only a sketch of the blank has been furnished, the first thing to do is to make a blank by scribing and cutting it out from a piece of metal of the same thickness as the punching wanted. A rough sketch

FIG 7

Simple purich and die method of drilling die two-piece die, and gages and claims

of the punch and die then should be made. This need not be fully dimensioned, but clear enough in detail so that the design is understood and the material can be ordered from it.

The punch and die (Fig. 2) are well suited for this blank. The cast-iron die



shoe shown is adaptable for a variety of work, and therefore usually is carried to stack. It is shaped off on the bottom, turned over and the doverall is shaped out to preive the die. A gage (Fig. 3 should be enade for gaging the dovetail accurately and for testing the corresponding dovetail on the die. The dovetail in the shoe is cut on one side to a taper of by in, to the foot, to suit the taper of the wedge that holds the die in place.

The die should be made of good quality tool steel. It is shaped to fit the shoe with the wedge in about a central position. The top face is finished off smoothly and a coating of copper is given to it by applying a solution of blue vitriol. This makes a good surface for scribing the blank's outline.

BY CAREPULLY laying out a series of prick punch marks for the disopening, it can be drilled so that only a thin wall will be left between the holes, as shown in Fig. 4. These holes are reamed with a taper reamer from the bottom so that the die will have the proper clearance.

A chirel (Fig. 5) is used to cut down the walls between the holes in order to remove the core. The dis opening is then filed so that there remains only a series of slight grooves left by the reamers.

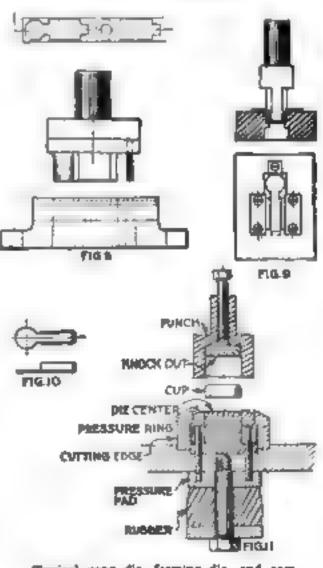
A stem now should be soldered or riveted to the blank so that it can be held while it is being fitted into the die. The die should be held vertically in a vise, with a strong light in front of it, so that when the blank is being fitted into the die from the bottom, the high points that the blank eatches on can be seen clearly and marked. The die then is filed at these high points, and the blank again is fitted. This is repeated until the blank touches

all around and is flush with the top face of the die.

A clearance gage (Fig. 6) at an angle of 91 degrees pow should be made. It is used when filing the clearance that permits the blanks to fall freely through the day. Care must be taken in filing out die openings to see that the cutting edge is not rounded or tapered in the wrong direction. This can be avoided by testing frequently with the gage. In this particular die, one end is a circle, so there is no need of filing if a suitable taper reamer is at hand.

After drilling the hole to take the locating gage, the die is ready for hardening. The hardening usually is done in a gas furnace. The die is brought slowly to a cherry red. It is advisable to heat the jaws of the tongs with which the die is handled, otherwise they are apt to chill the die where they grip it when removing it from the furnace. If there is no pyrometer to the temperature of the die, and there is doubt as to just how red the should be, it is advisable to put a few schape of the die steel in the furnace to heat with the die. These can be used as that pieces, so that by dipping them in water and testing them with an old file for hardness, the right heat can be secertained.

(Continued on page 94)



Typical gang die, forming die, and combination die med for making cup shapes



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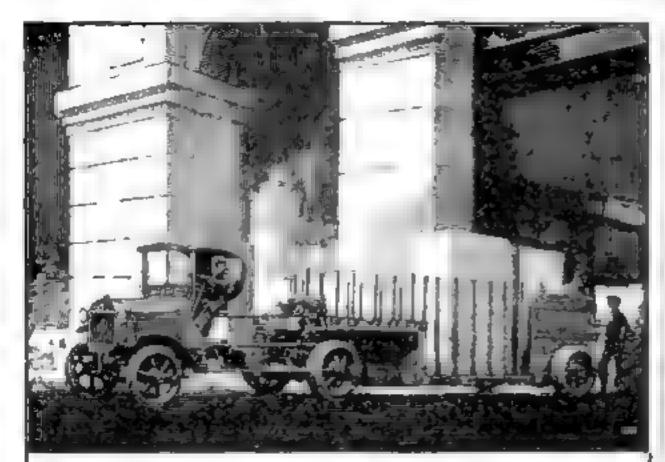
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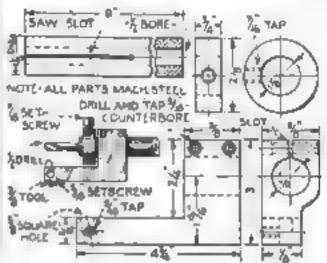
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HANDY drill- and tool-holder for use on screw muchines and automatics is detailed below. Simplicity of construction, operating efficiency, and low cost are among its features.

The body of the holder is made from a solid piece of machine steel. It is provided with a clamping arrangement for



Details of elempic dust purpose tool holder for the on screw machines and automatigs

holding the drill and a slot in the project ing lug for a southt, which is it for the required dimeter

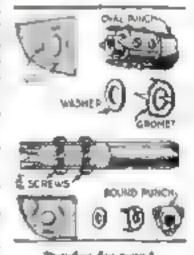
The turning tool man be adjusted shoriffs for any diam ter within of the to a Drille of various sizes may be used either by turning the shauk on large and the split bushing or by using a ste split bushings for the smaller SIZES - JOHN LARRON, New Britain, Conn.

Making a Gromet Punch

WHEN repairing old side qurtains, or refitt providenta, a gramat punch is a handf tool Many methan-Me wlota ica attempt to process and the les for the white it indicated in one, but shadt the leather, and it a result is a

2 comet offenh is made Trom a piece of chuel steel, the lower end being shaped either oval or round to suit the type of gromet used The oval atyle has four prongs, while the round has three.

The opening punch is tapered out internality to a sharp cutting edge, and



and oval growers

the sides are then filed off flat for the reception of the prong hose knives, the rear ends of which set against the square corners of the filed-off flats. These knile blades are made of annealed backsaw blades, the thick nower saw variety being the best to use. They are ground with an inside radial bevel, as shown, and should be whetted very sharp.

IN ALL cases where muc chlorid is used as a flux, the article should be cleaned thoroughly after soldering.



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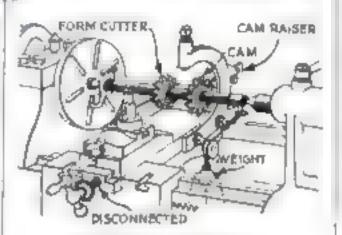
"The Standard of the Mechanical World"

Relieving Milling Cutters on an Ordinary Lathe

By John Aures

THE relieving attachment illustrated below for backing off form cutters in a lathe, should prove very useful in a small shop where there is no obecal machine for this class of work. This simple arrangement will do the work about as well as an expensive elleving machine.

gear after having the admensioner of teach as the cutter to be backed off in held on a politing machine arbor or keyed on appeals arbor about 2 in, from the other cutter and the arbor is placed bety ten the lathe centers. The gear-cutter,



A gree cutter is used as a cam to transport motion to the lathe tool

which is to be used as a cam, is placed on the arbor just the reverse of the cutter to be backed off. The follower rest is holted to the carriage and a piece of hardened steel, ground on one end somewhat like a tooth on the carr cutter, is fastened to it in place of the usual piece of brouse.

Disconnect the cross-slide screw where it is screwed to the apron and fasten a weight over a pulicy on the cross carriage. The cross-slide screw is set so that the weight will pull the lathe tool clear of the tooth for the next one as the cam rises. For feeding the tool to the work, the compound rest screw, of course, will have to be used. The lathe should be run on its slowest apped as the tool's working in and out naturally will cause a chatter.

Marking Wood with Try-Square

BY BURRING over the edge of a try-square and sharpening it as indicated, a carpenter can mark small lumber for nawing by merely pressing the square in place. The



edge learned sharp mark that is more argurate than our maderwith a pencil and the time needed in hanning a pencil is saved. The device is especially useful when a large number of small pieces have to be marked. H. E. H.

Bruzing Bandsaws

AFTER many wearisome experiments A with fluxes for brazing bandsaws, find that a mixture of 3 parts boris and and I part of borax dissolved in just chough hot water to make a boutton, ica catis actory combination —W. A. LYON

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FUNNY thing about women folk. When they put us on one of those round-thehouse carpenter jobs, they not only tell us we've got to do it but they look at us in a way that says we com't!

Let's get together on this thing, men! We can't do a regular job when we use a canopener for a screw-driver and a bread-knife for a saw, We've got to have tools-good tools.

Let's show 'em. Begin to assemble your complete tool outfit with a Simonds Hand Saw, a Simonds Hack Saw and a Simonds File. Then you'll have took-took that were famed for their cutting qualities before most of us cut our baby teeth.

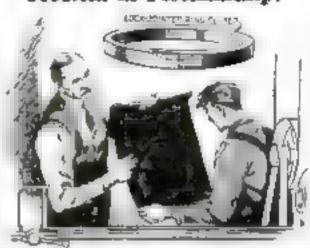
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MAGINE for the moment that you are a machine-shop foreman. You have just received a blueprint on which is detailed the special interlocking piston ring illustrated above. It is for use in connection with a small air pump, and a glance shows you that the designer and it necessary to lock the rings securely because of the design anglocation of a port. If you have handled similar problems before

before, perhaps you will not have to think twice as to the lest method for markings the riegs, but the question is—how will you explain to a relatively green machine happens amplest and quickest way. It's

a poblem in foremanable. For the elearest letter giving this information, Popular Science Monthly will award a first prize of \$10. For the next best letter, a prize of \$5 will be given. The contest will close on May 20 and the winning letters will be published in the August lieue. No letters returned. Address Shop Contest Editor, POPULAR SCIENCE MONTHLY, 225 West 89th St., New York.

Cutting-Off Lathe Tool

MOST machinista experience trouble at some time or other with their cutting-off tools. When you are up against a tough job, try a tool made as illustrated. Thus le a conventional tool altered by culting

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Makes shearing out

The unit makes a steaming out man, used on rast from never man in. I have made do tun o more deep with a that is in wide without breaking it. S. L. ROBERTS.

Bail-Turning Tool

OR turning hall ends on ateel rode and oming tool is necessary. The hand tool illustrated in the

signed for nhishing such work after it has been carefully roughed out to a templet by manipulating the lathe carriage

and cross feed. A tool of this type is especially adaptable for brass work.-H. W.



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Die-Making Simplified

(Continued from page 86)

The die should be removed quickly from the furnace and dipped vertically into a large tank of lukewarm water and gently swayed back and forth until it is cool enough to touch with the hand; then it should be left to cool in a bath of oil.

The die is now hard—too hard to stand the shocks to which it will be subjected in service—so it is necessary to draw the temper somewhat. To do this a plate is heated to a red. The top face of the die is polished to remove the scale and the die is put on the hot plate, face up. As the heat penetrates the die, the polished surface will assume a straw color. If one section seems to color too rapidly, that part can be retarded by bathing it with oily waste. After the die has reached an even straw color, it is cooled in oil.

THE bottom of the die now should be ground flat in a surface grinder. The top also should be ground, but it is ground tapering from the center toward each and to give the punch and die a shearing action. This reduces the shock to the press. One of the best and simplest methods of fastening the punch to the punch holder is by filluter-head acrews and dowel pins, as shown in Fig. 2.

The punch is laid out by scribing the outline of the blank on the face of it and then is machined to the scribed line, just shough metal being left for fitting. The cutting edge of the punch is given a slight chamfer so that when the punch is set up in the press and the die brought in place under it, the punch can be started into the die. While the punch is in this position, the die is bolted down.

If the punch has been carefully made and set, by bringing it down with a light bump on the die, a distinct impression of the die will be made on the soft punch. The punch then should be raised and the excess metal filed off so that when the punch is brought down again, there will be only a light shaving taken down the sides of the punch.

ON PUNCHING thin stock it is necessary that the punch and die fit snugly; but on heavy stock it is customary to leave about one-tenth the thickness of the stock as clearance between the punch and the die.

Practice varies as to whether the punch should be hardened or left soft. There are many points in favor of both methods, but in the majority of cases it is left soft. This is done because the punch is a simpler part to make than the die if, through improper setting, one of the two becomes sheared and spoiled. Also, when the punch becomes dull, it can be sharpened by upsetting the cutting edge with a bammer while the punch is still in the press, and shearing the upset edge through the die.

The difficult work (if it may be called that) is now finished. There remains only the fitting of the stripper plate to the top of the die. This consists of a flat plate with a slot twice as deep and a little wider than the stock being punched. The opening for the punch to pass through is made a loose fit except when the punch is long

Continued on page 96)



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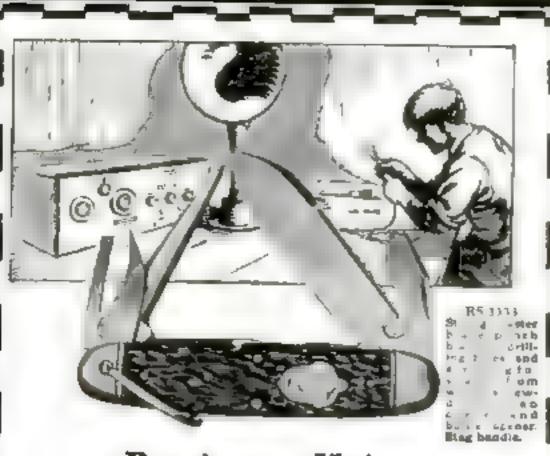
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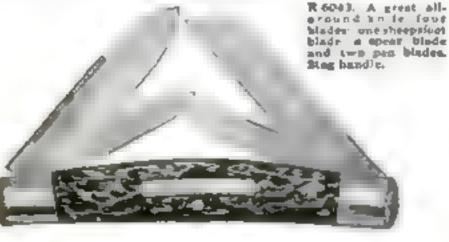
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Die-Making Simplified

(Continued from page 94)

and thin; then it is necessary to make the punch a sliding fit

The hole in the shoe for the blanks to pass through should be cut larger than the opening in the die so that if the die is set a little off center, the blank will not catch

The gage pin for locating the stock is made in the shape of a flat-head rivet, one side being filed off so that a flat surface is presented to the stock being punched. There should be sufficient apace between the top of the stop and the under side of the stripper so that the stock can be passed freely between them.

The punch and die now being ready to operate, a strip of stock is put into the die so that it comes up against the gage. Then the prem is tripped and a blank is punched. As the punch goes up, it carries the stock until the stripper strips it from the punch. At this point the stock is pushed forward so that it passes over the gage and the stock stops against the side of the opening that the previous blank came out of. A little experience makes it possible to run the press at more than 100 revolutions a minute.

There are many factors that affect the design of a die, one being the number of punchings wanted. If there are to be many, it pays to make an elaborate die; but if only a few thousand are wanted, a pretty crude die will prove satisfactory, as the blanks from both dies may be identical

Sometimes a blank is so narrow that it is impossible to machine the opening in the distill is made in one piece, so a split die is made as shown in Fig. 7. The two halves usually are held together with

taper pins.

A forming die, such as is shown in Fig. 9, should be made when it is necessary to hend up the three sides of our blank in Fig. 10. This die consists of a plate with an opening over which a blank is put in a nest made of the three locating plates shown. The forming punch has one and machined to fit the inside of the formed blank, while the opening in the die corcesponds to the outside of the turned-up sides. When the punch comes down on the blank, it forms it as it carries it down through the die

THE gang die combines two or more operations at one stroke of the press on two or more blanks. Where it is necessary to punch a hole in the circular end of the punching first described, a gang die, such as is shown in Fig. 8, would be more economical than two separate dies. As will be seen, two operations are performed on the stock at one stroke of the press. The first blank punched is without a hole, but at each following stroke of the press a complete blank drops through the die. As many as 10 operations may be performed consecutively in this type of die.

The combination die differs from the gang die in that it performs two or more operations on one piece at one stroke of the press. In these dies are usually combined blanking, drawing and sometimes forming. This type of die is extensively used in making cup-shaped work. The

Continued on page 98)



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Sixty-seven years of fine plier making are behind the comfortable way the handles are shaped, the easy spring of the handles, and the careful tempering of the keen knives.

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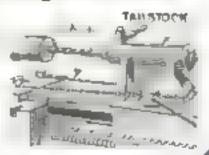


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WHEN
drilling
deep holes in
a lathe, the
drill usually is
fed by hand
and on extra
long work it is



change the position of the tailatook serveral times. While this is all right for infinity one or two pulces, it involves a considerable loss of time when they are a full oper if similar pieces.

is such a river turn may be haved by maring the lacks at about so that the privage will find the tailstock along with the power feed — F J W

Die-Making Simplified

Continued from page 96)

drawing or cupping of sheet-metal into intricate shapes has opened up a field of work that seems unlimited. The shapes that were obtainable only by spinning a few years ago, today are made much more cheaply in drawing dies.

When it is necessary to make deep drawn work—that is, deep in proportion to the diameter—it is necessary to do the drawing in two or more dies. This is because the metal hardens in the drawing and it is necessary to anneal the cups batween operations

On plated stock, such as tinware is made from, annealing is impossible, but if the stock has been properly annealed by the manufacturer and the tools well designed, reasonably deep draws are possible.

The ordinary shoe-polish can is an example of the product of the combination dis. A section of one is shown in Fig. 11 and it will be noted how compact is the design. The shoe contains a toolsteel cutting edge and die center. Around the latter is a pressure ring. This ring is held flush with the cutting edge by a pressure pad containing three pins, which are forced up by a compressed rubber pad on a slud below the press. The punch contains a knockout pad with a stem projecting through the shank of the punch. A suitable locating gage and stripper (not shown are used.

This die is operated as follows: When the punch comes down on the stock, it cuts the blank and at the same time grips the blank hetween the face of the punch 4 id the pressure mag. As the punch contrues down, the pressure ring also is forced down, thus compressing the rubber pad, which has exerted enough pressure or the blank so that it could not wrinkle while being drawn into a cup. When all the stock has been drawn over the die center and the punch starts on its upward trip, the pressure ring strips the cup from the center so that it is carried up in the nunch. As the punch nears the and of its stroke, the stem of the knackout comes in contact with a stop, thus forcing the cup from the punch

The rapid strides that have been made in the past few years in die work make it advisable for the average machinut to familiaruse himself with this line of work, as many of the jobs that were made in the past in some form of machine tool are now being made in the punch press.

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through weeds shallows and over hidden obstructions that would damage any other so-called "taiting motor." The Called direct drive principle has proven its correctness to thousands of users over a period of four years. The power is transmitted direct to the propeller. Has no beyel gears to waste power and give trouble. Our challenge to other builders to follow us through weeds, shallows and over sunken obstructions has never been accepted and still stands.

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Simple Inspection Gage for Testing Thread Sizes

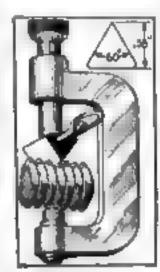
By George A. Lucra
Automotive and Mechanical Engineer

WHILE a number of methods for measuring the threads of acrew parts are in use, one of the simplest possible ways is by means of an ordinary micrometer and the triangular steel block illustrated. With this commination the thread size may be obtained who an accuracy united only by the security of the micrometer, even as close as .0001 in. In one name pally prown manufacturing pant this labely has superseded other screw-gaging methods.

The gage piece is accurately ground that steel with an included angle between the surfaces of 60 degrees and an altitude of .88 in. from the base to the apax of the opposite angle. A ring is attached to one

end to enable it to be handled and carried more readily. Two edges of the gage are chamfered, as shown, for use with the U. S. Standard and A. S. M. E. threads.

In the, the gage and acrew to be measured are placed as shown. If a U. S. S. thread is being tested, the micrometer reading is compared by using the following formula;



Gage block teed with sucremeter

- 35.- golbate reteneralman metendog - .35

7577 Throndo to the inch

As an example, take a standard machine screw having 14 threads to the inch. The micrometer reads .?769 in. Substituting in the formula we find an external diameter of .46 for the screw. This is the actual maximum value allowed for this size and type thread and the screw is therefore accurate. The constant is obtained by adding to the thread depth, which is .6495 in., the value .10825, which is the depth of a V thread having a width equal to the flat at the bottom of the thread.

Where V threads are being tested, the same formula is used excepting that the constant used is .865 instead of .7577.

The method is applicable to large and small screws. Instead of working out the formula every time a screw is tested, it is possible to make out a table that will give the results immediately. In that case it is just as well to arrange the formula in the following order:

Micrometer read ug = outside dinmeter --

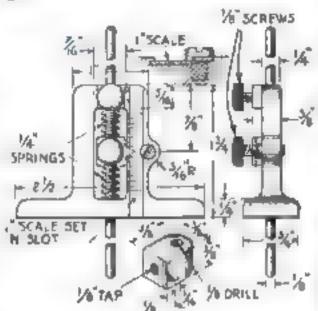
.7577 (or 866) + .14 m

A giance at the table then shows whether or not the actual micrometer reading is what it should be, without considering the steps by which the result has been worked out.

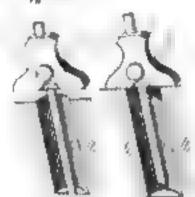
To corperize brais, first wet with bluestone solution and then rub with some fine iron filings.

Indicating Depth Gage Shows Amount of Error Automatically

THE usual depth gage does not indicate the amount yet to be cut or just amount of the overcut in books or being machined. This and a more a will do both. It therefore a door of the angethelexact tepth requires with fewer trum them are arrest depth requires with fewer trum them are a first set for the approximate



Details of the indicating depth gage mbay e and. method of using it eat right ... If hole or dot te not deep enough or is loo deep, the poster shows the difference

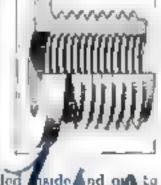


depth is reached, the scale is placed in the hole and the holder is pressed down as far as it will go. The variation in the scale reaching gives the distance to go.

If the hole is nifeady too deep, preming on the rad will cause it to move down, and again the score reading will indicate the error. The spring automatically returns the rod to its original position of sero reading .- HENRY S. LARABY.

Lathe Chuck Adapter

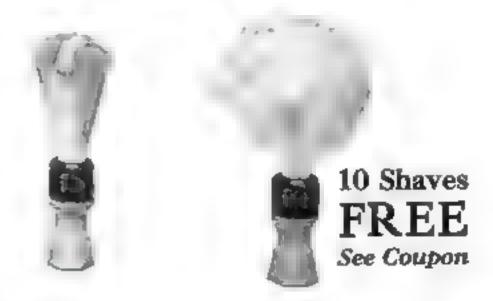
TN SMALL shops having only two or three lathes, each of a different size it. is sometimes desired. to use a chuck of one lathe on another. The illustration shows an adapter for this purpose. It



is made from wild, tomatee and thrested aside and out to and the lathes for which it is introded. The outer threads should be gut we it is for med on the lathe sound to insure its maning true. -H L. W

Bending Pipes by Hand

O BEND appear by hand water pper a type fil the pae will diff sand, p p. or say the ends to return the



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The work in inserase shown as plant book, is inquirted in any contenient matter on whatever type of fixture is

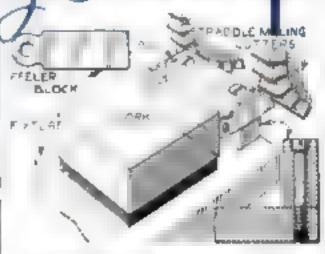


Diagram showing how the gage block and feeler blocks are used to lasure accuracy

used. Screwed and doweled to the base of the fixture is a block 1/16 in. narrower on each side than the required distance between the cutters or finished width of the work. The feeler blocks are separate hardened and ground gages 1/16 in, thick. They are used in connection with the fixed block to determine the distance between the cutters.

With this device cutters can be set up for repeat runs at any time and the operator is sure of the work's being right.—
W. BURK BENNETT, Bloomfield, N. J.

Calipering Holes while Boring

THE difficulty of ealspering a hole that is being bored with a borney par in largely averdame by beauting the rigs of the cultivers at a angle of abore 45 degree. The hand should be made an inch on two from the andir.—J

Compressed-Air Whistle Used for Factory Call System

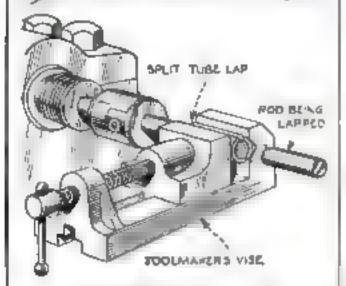
AN EFFECTIVE factory call system can be installed cheaply in any plant that uses an ordinary air compressor. On the compressor is mounted a small whistle of the kind often used on automobile trucks. A rope leads from the whistle in the shop to a position convenient to the man in the office who greets callers.

In one plant where this system is used, a code has been devised—one blast of the whistle for the manager, two blasts for the superintendent, and so on. If the official of the company happens to be out in the shop when a caller arrives, the office man without leaving his desk gives the proper number of tugs on the rope, and the blasts of the whistle are loud enough to be heard anywhere in the shop

The idea is especially well adapted to shope where there is considerable noise so that the ringing of an ordinary electric bell operated by a pushbutton would not be heard.—John Matter, Marion, Ind.

Vise Used in Lapping Hardened Steel Rods and Pins

THE most difficult part of a lapping job, where hardened steel irods and pure are to be imped a few thousands of an inch in a athe, athe locating of the lap. This can be channeled by using, as shown, a length of ap it brass tubing of a decideter that will show the rod or put to



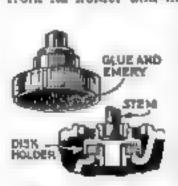
The lap, which is a split bress tube. In held in a toolmaker's was

enter freely. The tube is held in a tool-maker's vise, and, after the rod is inserted, the rear jaw is tightened. The vise then is moved back and forth over the rod and fine emery and oil, or valve-grinding compound, is used as an abrasive. As the isp were down, the jaw is tightened to close the tubing on the rod—Jok V. Rostic

Globe Valve Seat Grinder

A TOOL for refacing the brass seats of common types of globe valves can be made as illustrated for a few cents in half an hour. It serves fairly well in place of special tools, which in the larger sizes are quite expensive.

Remove the composition or metal disk from its holder and fill the space with a



Disk holder filled with glue and emery

paste of thin give and emery powder, using as much powder as the glue will take up. Level the top while it is damp and set aside to harden. Unscrew the atem from the valve with the holder attached, plage the stem in a ci rpe

ter's brace and use it to refere the sent See that the valve is dry so that it gare will not be soltened or discovered.

When ready to replace the vilve stem, socked in hot water form few minutes and the gifts, and emery will melt. I have made a first class job of refacing 3- and 4-in, valves by this method. A regular grinder for these sizes costs, I understand, about \$25.—James E Noble, Toronto, Canada.

A NUMBER of fathe shortcuts used by expert mechanics and a feature article, "Getting the Most Out of a Lathe," are scheduled for early publication in the Better Shop Methods Department.





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This new Williams stick offers you a man's grasp—totally different from the finger-tip hold of other shaving sticks.

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laying out mechanical drawings,
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may be made by
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mak. The a retog-



Fitting a Swivel Base to a Plain Bench Vise

A BENCH vise with a plain base, which cannot be swiveled into the most convenient position for working, usually can be fitted with a swivel base without much difficulty.

Two duka of iron or steel plate, about



Two dieks form

jo in thick are provided, one to fit inside the edges of the bolt holes in the vise base and the other about 1 in less in diameter. The duka are bolted jointly to the bench top. The vise a last and the vise a last and the control of the bench top. The control of the bench top. The control of the bench top.

to them with to to not becare the number of the control of the distance of the control of the co

A small swing handle, made from a stain of steel and a pin. In added to the hear of each of the bosts. The vise then can be swung around and locked in any position desired —G L.

Chip Blower for Deep Holes

STONE cutters and mechanics often have difficulty in removing chips and dust from the bottom of holes that are very wide or too deep for the common type of blower to operate. An effective

The nor cutp han a mabber akutt

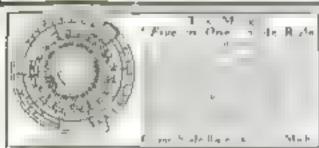
chip blower for such work can be made an illustrated. The cup can be made from a pipe cap by first turning the threads out on a lathe and tapering the edge. A rubber skirt is attached at the lower edge. Two brass tubes are inserted in

the cup, being either threaded or soldered to thand a band may he soldered around the tubes near the top to give added strength

dust and chips and carries them out of the other.—C. A. MARTIN, Lewisburg, P.



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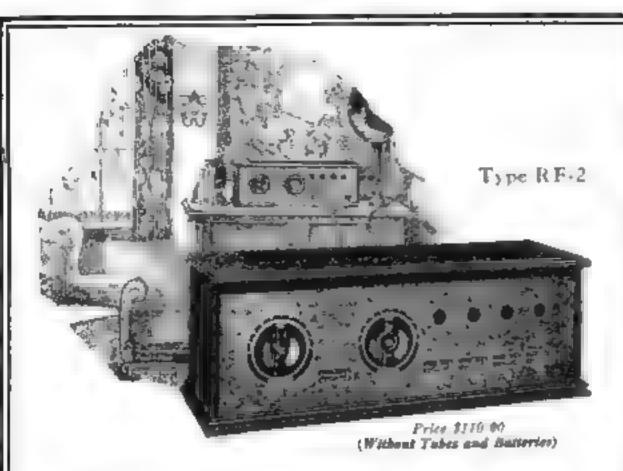
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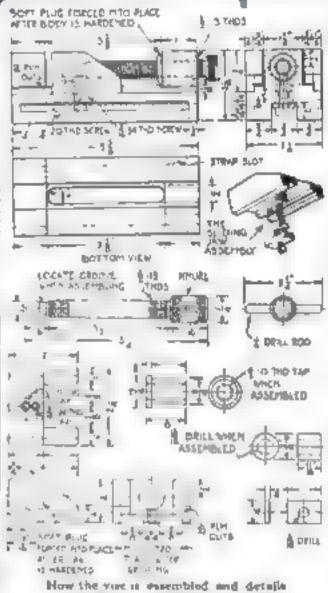
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The Real Estate Educator

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Toolmaker's Accurate Hand Vise Has Renewable Threads

T'HE toolmaker's hand vise illustrated has several marked advantages over the type ordinarily designed and made by mechanics for their own use. The slideway on the bottom slide runs out at each end, so that it is possible to finish the vise all over before grinding. Furthermore, the screw can be made a anug fit so that the jaw will alide without binding and have almost no play indeways and up and down, as is unavoldable in vises where it is impossible to line up the screw prefectly. The nort plum provide in easy bethod of renewing the thread of it should be Dones in any way by migule not line up. The machine steel vise body, 1/16 by hydra in a ground squar all over, nd the slide is milled out with 🜓 🎠 by 8 🎉



in, side cutter, which also is used to mill the body post. The fillets in the body post are milled with a 1/16-in, radius at the corner. The middle slot in the body then is drilled out with a 7/16-in. drill and molied with a 7 16-in and mill and a vertical head. The buttom slide is milled 14. in wide and 2 in deep, with a 42 by 3 in side cutter, the work being reversed to cutthe elet central

of the fewn, screw and other parts

The jaw slide and the strap slots are cut with a ', by 3 in side cutter. The minouts are cut 1 16 in wide and shout 1 16 to 1 in deep with a inlifin saw, the body of the work being tilted at 45 degrees. The work is then fastened to a athe fareb ate against an angle iron and the post drilled with a first drill and bored to be in.

Following a somewhat similar process, the vice paw, 1 , by 2 by 2 kg .n., is ground source all over, the bevel in cut with a

Continued on page 107,

Toolmaker's Accurate Hand Vise

Continued from page 106

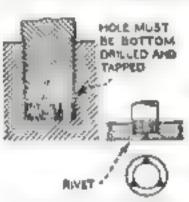
I 14 an slab miller, the screw slot is milled with a 2, by 31, ir side cutter, the runouts are made with a 1/32-in saw, and the hole for the soft plug is bored in the lathe 34 in. in diameter and 11/16 in. deep, with a square nottom. One of the screw holes is drilled as shown with a No. 34 dril and tapped 3 16 in -24 thd; the other is drived with a No 12 drill and

tapped 14 in.—20 thd.

The soft plugs are forced into place in an arbor press after the jaw and body are hardened. Then the body and jaw are ground all over. The jaw is made a snug sliding fit in the body slide, after which the jaw and the body post are bored and the latter is threaded for a *24n No. 13 U.S.S. thread. This procedure is as follows. Set up the work against an angle iron on the lathe faceplate, drill through the plug with a 5/16-in. drill 114 in. deep, hore the hole to the diameter of the bottom of the thread 4 in, boring until the tool touches the hardened jaw, remove the sliding jaw and thread the body post plug. For an especially fine finish, lap the body and jaw on a lapping plate.

Holding Stude Securely

STUDS with wingnuts that are con-stantly in use, as on jigs and fixtures, soon work loose, even if pinned in place. The following are two methods I use to keep the stude tight. In heavy material,



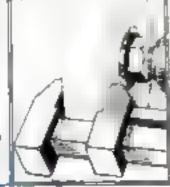
In beavy material (at left): is metal plata (at right) drill a hole into the end of the stud about half the stud's diameter and an equal depth. and countersink the hole. Next, drop a steel ball about 1/16 in. larger than this hole into the tapped hole for the stud and tighten the stud-

in place. The steel ball causes the threads to expand.

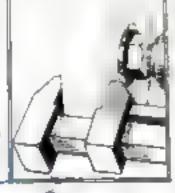
Where the stud is to be held in a thin ! metal plate, countersink the bottom of the bale rather obtusely and, with a diamondpoint church, cut three or four grooves down the sides of the countersunk part of the hole, starting with almost nothing and cutting in deep toward the center. Screw the stud in place and rivet it over firmly

Grinding Wrench Jaws

RECENTLY I saw an old machinut pick up a monkey wrench that had been discarded because of the battered condition of the jaws, and true them up on an inner wheel as about



Although this restored to mefulness.





In the Dead of Night

In the dead of night a fire breaks out—the alarm must be given. A child is taken sick—the doctor must be called. A thief enters the home—the police must be located.

In the dead of night the American turns to his telephone, confident he will find it ready for the emergency. He knows that telephone exchanges are open always, the operators at their switchboards, the wires ready to vibrate with his words. He has only to lift the receiver from its hook to hear that calm, prompt "Number, please." The constant availability of his telephone gives him security, and makes his life more effective in wider horizons.

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to represent us in the direct sale of a pipe to represent the in the direct sale of a pipe writch which embodies a new principle and represents the first real improvement in this tool. Now approved and in general use by some of the largest corporations. Salis on eight if interested, and \$1.75 casher morey-order) for 10° sample and full particulars. This is a real appartunity.

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typical Here's Snap-on selected Kit — a handful of special-steel units that do more work easier than 60 oldstyle wrenches at a fraction of their cost. A few dollars will buy a Kit for your car. Just fill out the coupon and we'll send full details.



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Please send me full particulars about Snap-on Kit for car (II interested in Master Mechanics Kit, check bere

I buy tools from

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Address

Attractive Rocking-Chair Easily Made

HIS comfortable rocking-chair is the companion

By Stanley W. Blanchard

direction of the mortise through the rocker by marking where the leg crosses the rocker. The four

piece to the upright habitant chair described in the April issue of POPULAR SCIENCE MONTHLY

It is a more ambitious project than the other chair, as there are several joints to



The enduring charm of this chase here in its timplicity and its uniquely good proportions

After the glue has dried for about 24 bours, scrape and sand the chair, finish as you please and then put in the seat as explained on page 82 of the April POPILAR NOTENCE MONTRLY.

well practised.

mortise-and-tenon joints are now cut out and fitted. The arm is fitted into place in the same manner, except the joint in front, which is a plain right angle. The two sides now being framed, the next step is to put in the grant and

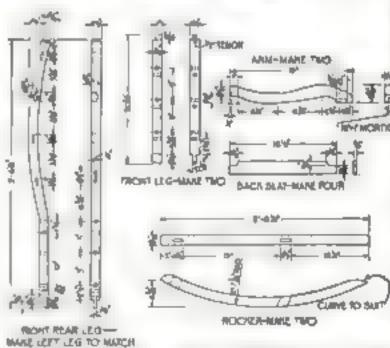
back rungs and the back date. Note that the horse for the rentiated backgrungs must be bored at an angle to allow for

Use fact must the chart is nirrower at the back than at the front. When bering, make a mide for your bit out of a few scraps of wood, or the holes may be bored

which the aid of the eye alone if you are

CUT the mortison in the back logs for I the slate and then assemble the chair, using strong glue and pinning the tenons into place with a M-in, dowel, if you wish to increase the strength.

Details of the frame. Also percentary are 6 unde gunga, le in long 3 front congs. 21% in long, and 2 back tuber 1844 in long, all to be 's in in districtor



be made at different angles, but it is well within the reach of any amateur woodworker who takes care in his work.

First cut out the back legs. the front legs, and the rockers after laying out the parts to cut with as little weste as possible. To have these pieces cut at a mill on a bandsaw is not expensive and it eliminates the hardest physical part of the work.

Bore the 🏰 in holes in the front and back less for the side rungs only. These holes are bored straight through at right angles to the front of the legs and not at an odd ungle, as are the holes for the front and back runge

PASTEN a back and a front leg together by driving the runge into place. This will hold the lege in their respective positions so that the rocker may be laid in its place at the ends of the legs and the shoulder of the tenon marked where the rocker crosses the legs. Then put the rocker under the lega and obtain the lines for the

Friction Tape Serves as Belt for Small Motor

ORDINARY tire tape sometimes may be used to advantage as a belt for power-driven dewer FOR LIN stance I bund it bard to make a short belt drive a small entrifugal summy ope rated, by a lashp, electric motor

wrapped both pulleys with a single thickness of the tay tape and then took the tape and drew a sround the pulleys, making only one turn, but allowing about 2 it for oversipping. I pasted the tape frin.y when a lapped. One thickness of tape refer the pump at 6000 revolutions and the faction previously due to a tight belt is filminated -F H. HERTELER,

Home Workshop Sewing Table Maintains Its Popularity



Bewing table and a one-third scale toy model made from Home Workshop, b

a first Alome Workshop bluepant published by Popular Scinker Mountaly, which gives the working de-tails of a sewing table, continues in de-(Continued on page 110)

Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to provide, upon request, information relative to tools, material, or equipment. Blueprint Service Dept

Popular Science Monthly 225 West 39th Bt., New York

GENTLEMEN

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....eente

No.	Trife	Pance
1	Sewing Table	75c
2.	Smoking Cabinet	25c
3.	Book Trough End Table	15c
5.	K tehen Calenet	75c
ő.	Two Stage Radio Receiving Set	23c
di.	Shaving Cabinet	250
9	Arbor with Gate and Seats	23
10.	Porch Swing	35c
11	Bench and T is Top Table	25c
12.	Blemms Washing Machine	250
11.	Ten Wague	239
14	Toy Train Horse and House .	25c
15.	Home Workship Bench	25c
16.	Inlest Radio Cahnet	25c
17	Cedar and Mahogany Chest	
18.	Telephone Table and Stool	. 25c
19	Grandfather's Clock	
20.	Figt Top Deak	
21	Colonial Writing Dealt	75c
22	G ros Cabinet and Desk	350
33	Permits Greater	250
34	Gate eg Table	35c
25.	So our Outfit for Cartos	25c
76	Boby a Cr b and Play Pen	35c
27	Kitchen Cabinet Work Table	15c
28.	Pullman Play Table	15c
29	Toy Tes Car Barage etc	25c
30	Tool Cabinet Search Hook ste	1028
31	Procille Sewing Cubatets	March.
33	Chinese Game Table	2630
33	Pullman Dining Alcuve	25c
34	Treinses for House and Gorden	25c

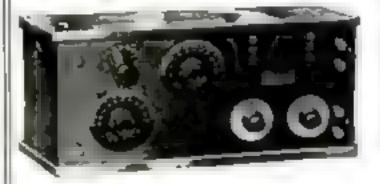
Name

Please (mint)

City and State..



Every One Can Now Own a Quality Radio Set



This is Model K the

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Ribott of Milford New York got Lon-dro Engund Fart banks A sake La Pal-

me Peneme Sun Francisco Los Asgeles and about 121 other

long distance stations. It s a two-tube outfit that sells \$29.50 for only

MODEL M.M.

Shown in the illustration of the top of the page is our 4 tube out

sells for maly \$34 50.

for only

These two Improved Miraco modela make it possible for every family to own their own set-to have a choice seat for the opera or symphony or jazz concert right in their own living room.

Improvements and refinements that appear in expensive sets only are built in each and every

MIRACO. In other words, highest quality at the lowest price has been solely responsible for the sale of thousands of our acts that are bringing radio-joy to each and every family who own one. Users of Miraco sets report getting as many as fifty stations in one evening,

The cabinets are of solid mahogany and workmanship is unexcelled. Easy and simple to operate and always de-pendable. Fully GUARANTEED against any defects in workmanship.

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There's still some territory open-write or wire THE MIDWEST RADIO COMPANY 308 Main Street, Cincinnati, Ohio

The Improved



The All Purpose Hoe Wrench

Everywhere you can use a wrench you can use a HOE. No wrench has ever before been manufactured that combinesso many advantages.

Quickly and easily put on pipes. Grips in difficult places, will not alip or let go. Does not clog in mud or sand. Grips nuts square and holds them

\$1.25 them.

Manufactured of the best and strongest materials obtamable. Fully guaranteed. Order through your local dealer or direct from the factory. The HOE is Strong, the HOE is Durable, the HOE is Simple.

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Hoe Corporation Poughkeepsie, New York

Atlast!a 100% Woodworker



2 ipoh Ofraular rip saw 4 inah Ciroular oross owi saw 51 inah Band saw 4 inah Jointor Chaper 18 inah sander Jaiko — 16 inah swing

PARKS Cabinet Shop Special is absolutely the most complete small shop equipment you can buy! Everything in one compact unit with motor! Just the machine for your home shop who the cubinet maker—novelty and toy-maker—special furnities builder—for the farmer who makes his own

of the embinet maker—novelty and toy-maker—special furniture builder—for the farmer who makes his own trates, bre-haves, etc. No end to its usefulness

Complete, or without motor and attachments to mit your seeds.

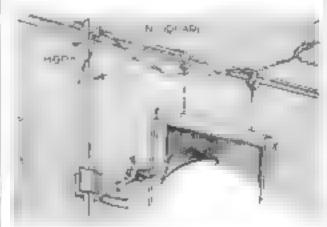
Write for circular

The Perks Bell Busing Machine Company 1647 Kameritan St., Cincinnati, O. Smales Febry: 300 Kets Bess East, Hestral, Sec.



A Portable Electric Lamp Hung from the Picture Molding

TO INCREASE the usefulness of your portable wall lamp, get a length of bard wood 1 in. square and 5 ft. long, stain and finish as desired, attach a modified picture hook at one end, and suspend from the picture molding. Clamp the portable light at any height desired and carry the cord up through a cup-hook



The lamp can be lung snywhere in the room and placed at any height

screwed to the top end of stick and continue over to the electroner

Rooms where the portable is used most frequently seldom have wall makets for plugging in, but with this device the cord in incompleuous and but of herm's way. There is no accessity for making walls or woodwork with access; the plunger of scratching bed frames or highly polished to pitting by direct clamping is eliminated, that it premits shifting the light to any heacht and to any part of the room with each and safety. For subdued or indirect light the lamp can be turned up toward the ceiling.—H. G. WEEKS, Colorado Springs, Colo.

Home Workshop Sewing Table

(Continued from page 100)

mand among amateur woodworkers. The original tracing has gone through the blueprinting machine so many hundreds of times that it will soon have to be replaced or the number withdrawn. But copies are still available for those who fill out the coupon on the preceding page.

A table made from one of these blueprints by H. N. Aldrich, a banker of Rosaliu, Neb., is illustrated at the top of that page. Mr. Aldrich writes as follows:

I am besewith sending you a photograph of the sewing table made under your blueprint No. 1, or rather two tables, out of which is a one-third scale model made as a Christmas present for my daughter

Right here and now I want to express my appreciation for the service of your department.

The photograph really does not do justice to the table. It was made from South American mahousary, polished, with bardware of brain and nickel. The pieces were all cut to measure before assembling and no good was the biteprint that not one bit of cut-and-fit carpentry was recently.

The table cost me in the neighborhood of \$10, which is a good investment in comparison with the price of the same article factory built, which is much

interior

An equally interesting photograph of an arbor built from Blueprint No. 9 will be shown next month, followed by other illustrations of readers' craftwork.

Glass Protects Radio Condenser from Dust and Moisture

To THE radio experimenter a glass-inclosed condenser is invaluable. An ordinary radio condenser can be converted into one of the inclosed type with nothing more than a 1- or 1 to quart jar and an old phonograph record

The top of the jar is cut off by wetting a fairly heavy piece of cord in alcohol, tying it around the jar at the point where it is to be cut, setting fire to the cord and, when the flame has reached its height, plunging the jar into a bucket of cold water. If you have never tried this trick



A uniful condenser for experimental purposes

helore, experiment on some old jars first Be careful not to smear any surplus alcohol over the jar

When the jar is ready, cut or saw from an old record or other panel material a circular top by in larger in diameter than the jar Drill holes for the

The top with the condenser fixed to it is now attached to the glam par with residence wax. This may be accomplished by winding a turn of treatment the unit upside down, and pour ng the heated winner wax into the "gutter" between the tape and the jar. The wax may be obtained by breaking up bome discarded B batteries. When the wax is cool remove the tape.

This type of inclosed condenser is dust and moisture proof—It will find favor with transmitters and experimenters who desire to use a liquid dielectric, such as oil. This is impossible with many commercial types, as the condensers have bottoms that are merely holled on and are not leakproof—RUBERT P BROOKS.

Oilcan Makes Serviceable Lamp and Blowtorch

TO MAKE an alcohol lamp and how torch for soldering, cut the spout from an oilean where indicated by the dotted lines in the accompanying illustration so as to leave about \$\frac{1}{2}\$ in, of the spout

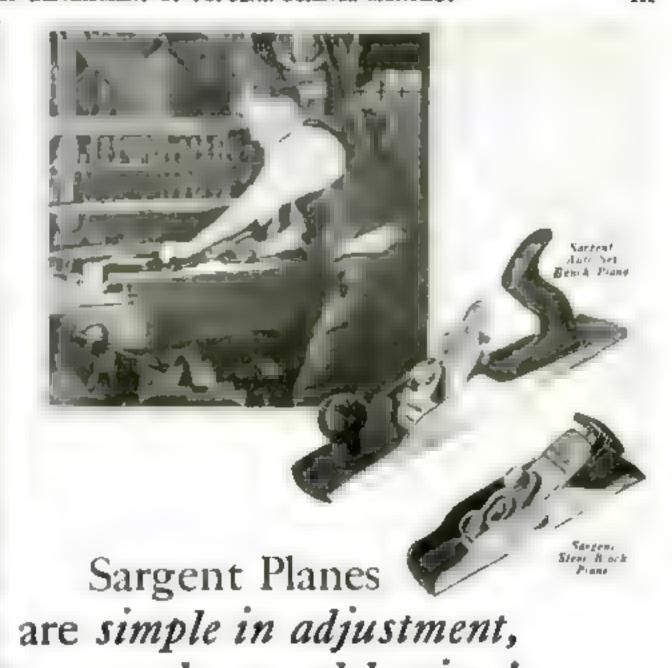


Method of countracting oilent blowtorch

attached to the can. Gut off the tip of the spout and close the lower end with solder. Solder this part to the side of the can and bend the end over sufficiently to allow a jet of air to strike the flame Dri' a small boys

the bottom and insert the type of evictors removed, soldered at inchiate

Then strain a length of subbergubing and a mountpiece the jet from which the surjes blown should be reduced to a very small hole. Candle luck is used in the burner,—T. F. DUNFORD, Detroit, Mich.



Reen and lasting!

The Sargent Auto-Set Bench
Plane is the hundient all round
plane you could have in your
workshop. It is true, keen cutting,
time saving. It can be used on the

requiring a clean, quick finish.
You'll find its adjustments remarkably umple. With the autoset feature you can remove the chromium steel cutter, whet and replace it without changing the original adjustment.

rougher jobs where a good deep cut

is a necessity as well as on finer work

Then there's the Sargent Steel Block Plane. This is small in size and a right convenient tool for any work bench. The special low angle arrangement of cutter makes it particularly good for cross-grain cutting and rough or knotty surfaces. And you can't beat it for the finishing touches or work in close quarters.

See these planes at your hard ware dealer's and write for the Sargent Book of Planes, which is full of detailed information.

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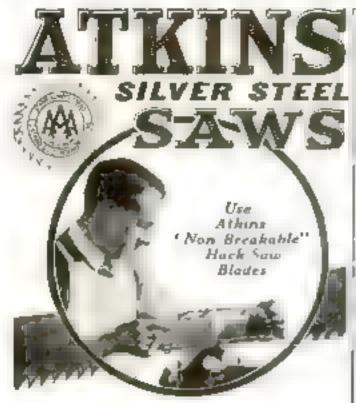
New Haven, Coon.

See top of page 6 in front



\$25.00 in PRIZES





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ATKINS "Non Breakable" Blades and Atkins "Easy-Grip" Hack Saw Frames make light work of the hardest metal-cutting job. The blades are specially tempered by an exclusive process, which makes the cutting edge extremely hard and the body unusually tough and flexible. That's why they cut fast, clean and easy, and do not break. Atkins "Basy-Grip" Frames direct full force of the stroke to cutting edge of blade. Nickeled and polished, adjustable 8 to 12 inches, bard cubber handle

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There are Atkins Blades for every metal-cutting machine. "Saws in the Bhop" gives the correct blade for each machine and job, and shows how you can get 26% more service with Atkins KWIK KUT Power Hack Saw Machines.



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The finest hand naw made. Blade is "Silver Steel" which cuts entier, faster, cleaner and holds its edge longer than any other naw steel. Beautifully finished, made with skew or straight back. Rose wood handle. Perfection pattern. "Saw Sense" gives full details of this splendid naw.

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Minhary of "Effect Stant" Education and Young Eate by Contors Briegatters.



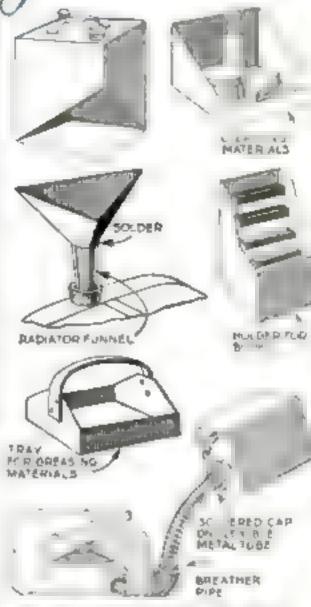
Conveniences for the Home Garage Made from Oilcans

MPTY 1- and 6-gal, offcana, which usually collect about the garage, can be made into many simple donventences by the car owner. In utilizing such that, the main considerations are that all cut edges should be turned over and that the soldering should be beauty applied.

the soldering should be leavily applied.

Five features are flustrated and they are so supplie that they can be duplicated by any motorist.

porter from a legal, container. The edges



Funnel shelf tray and book holder formed from polesne, and a flessble filling tube

to accommodate a 1 bin. tube made from the same sheet metal, which is inserted in the hole and soldered

For filling an inaccessible reservoir opening, a flexible section of \$1.0 or 1.0 metal tubing is soldered to the cap of the 1-gal. can.

A shelf for cleaning materials and polushes is made from the bottom of a large can by cutting the edges diagonally, turning them over, and securing the section to the wall behind the bench.

A tray for the greasing equipment requires one long side of a large can with a fabric strap for a handle. With this tray containing offcats, grease gun, cup grease, apring oil, gear oil, and various tools for the removal of oil and grease plugs, the lubrication of the car is accomplished quickly and easily. Another fixture in a holder for instruction books, clippings, charts, and auto references.

These few suggestions are typical of many conveniences, including drip pans, storage boxes for small tools, and holders for vulcanizing materials.—G. A.



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Corn transments speed your propfers insure as each Cord and age detect by weeld up exception. Fuchssive lessures, including the famous hydrausk expension of tubing, make Corner ensiest to play—beautiful in tone —perfere in scale — reliable in a ten- stade, valve of key -artistic design and britsh.

Prec Trial Easy Payments. Send for your, spy of Success in Music by Sound and other impurement, and details of trial offer. All one university for a feature of the your at the groups.

C. G. CONN, Led.





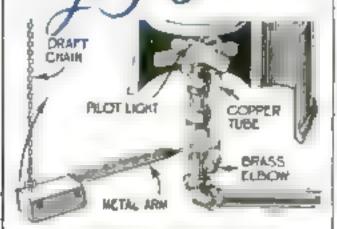
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PRO FORD Presentant 622 At you. Factory to consumer closel. Pay anti-One fruit.

Gas-Heater Control Operated from Floor Above

THE householder who lets his gas bills mount because he is too lazy to rup. down to the cellar and turn of his ca-water-heater promptly, can install semi automatic control at an expense had dollar and 30 minutes' work.

Bore a 1/4 in, hole in the garpipe below the heater valve. Tak it with a 6,16-to tap, and screw a a brais above, obtainable at any hardware atole. Swage into the abow a copper tube logg enough to reach up 1, to shove the blaner and bend over



Chain guil located upstairs turns on or off gue water beater in cellar

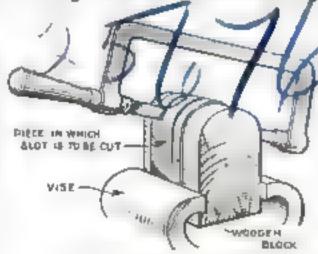
the end horizontally. The tip should be squeezed together to allow only a tiny flow of gas, which, when ignited, serves as a pilot .ight

Halt a metal or hardwood arm about I ft. long to the valve handle and provide a heavy counterweight. Run a chain from this to the first floor and fix hooks or other means for fastening the end. If the furnace has an upstmrs control, simply duconnect the chain from the draft door and use it, because you need the gas heater more in the summer when the furnace is out.

Varying Installations of furnace and heater will require modification of these directions, but there are few homes in which the idea cannot be worked out officiently -N. W. HOPKING, Detroit, Micha

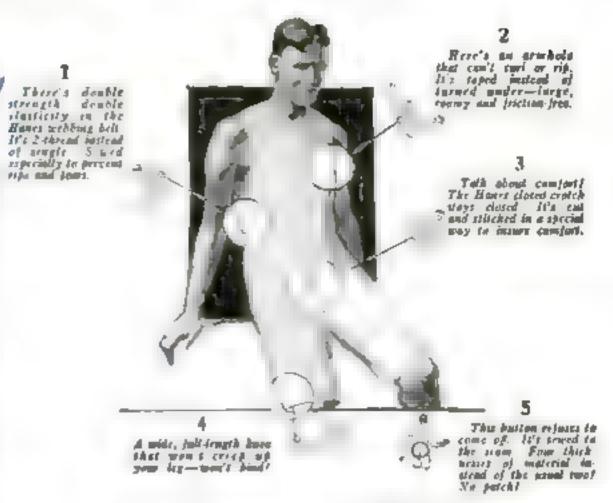
Cutting Slots in Thin Metal

SLOT in thin metal often can be cut quickly by bending the piece around a wooden form held in a vise, as shown, and using a harksaw. After the two long



The metal is light heat econori a wooden form and cut with a backware

cuts are made, the piece is flattened and the ends of the slot cut with a cold chisel. The edges are then trimmed with a file.—WILLIAM J. EDMONDS, JR., Whiteball, N. Y.



It takes real "fit" for summer underwear comfort

STICKY DAYS!! But you can come mighty close to comfort even when the cushion of your office chair feels us if it had been held over a blest furnace.

Hanes Athletics were built for your summer comfort. Think of free easy, loose fitting legs that never crawl into a bunch. A closed crotch that really stays closed. Think of all the things that have made you underwearconscious in hot weather. Square them against the famous five Hanes points 11

The price? A dullar, How we can make such underwear or such a price is the wonder of comfortable men everywhere. Hanes will pay you bigger returns in comfort and wear than noy underwear investment you ever made. It s simply unbeatable value?!



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Next Winter Wear Hanes Winter Underwear



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CARTOONISTS

BY W. L. EVANS





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water of the chowerest equipmentate are former students They had no experience before enrolling but worked at the lessons during their apara EV ANS' METHOD "oney to learn" and are new making good money. It is not hard to searn to draw serigimale when shown in a practical way, shoul the achool.

If you like to draw and want to be able to sell your drawings, send a samide your work seither a copy or an originals and let us see We will what you can do. send you the portfolio of cartness and full details

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YOU will find it a pleasure to work with Pexto Tools. They are made from highest grade materials, parts that require strength are drop forged, cutting edges are of best tool steel properly heat treated, parts that are liable to wear are hardened, in fact, all branches of our manufacturing and selection of materials are carried on ecientifically and each and every tool is carefully inspected before being packed for shipment.

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PEXTO TOOLS are carried by practically all progressive dealers.



WORTH WHILE TOOLS

The Peck, Stow & Wilcox Co. Southington, Conn., U. S. A.

Brick Base Insures Fine Flower Beds

SMALL ornamental flower-beds prepared by amateur gardeness often (ail to develop satisfactorily because of the



poverty of the soil. Simply removing the earth from the flower-beds and replacing it with rich dirt is not always sufficient, as the adjacent or under earth quickly

impoverishes the new soil.

This difficulty has been vercome by gardeners in Washington, I. C., where the flower-beds are universally admired, by the expedient of a town a corolar of ordinary building a way a circular retaining wal of the as illustrated These property in a rest, but are of the there is possible. to a bridge branch of a her bricks а сопет.

have leds are used in ground has been a single or in mainly clay or retaining the rich soil, - bricks absorb vast quantities of water. which is given back gradually to the

flowers.-G. A. L.

Small Condensers Aid Your Radio Set

THE proper placing of a fixed condenser often will make the difference between good and poor radio reception.

When a one-tube regenerative set is used, there is often no need for a fixed

condensor across the phones to by-pass the high-frequency current flowing in the plate elreuit around the high resistance to these currents offered by the phone windings. This is due to the fact that the cords of the phones provide the enpacity

required for the purpose. When one or two stages of audio frequency are used, however, the required expectly is removed as soon as the phones are taken out of the plate circuit of the director stage, It is advitable in such sites to use a .001 mid filled condenser agrees the primary of the first taknutormel-

Those who have been puzzled to know why the test stage does not step up the volume as it should, or find that they have to retune their sets when they plug their phones into the first or second stage after having first tuned in a station on the detector stage, usually will find that thus fixed condenser across the transformer's primary winding will eliminate the difficulty.

Noisy operation or howling in the amplifier stages often can be corrected by connecting fixed condensers of from .0005 to .002 mfd. across the aecondaries of the amphiying transformers. In some casts connecting grid leaks of from 15 to 5 megohms across the secondaries of the transformers will accomplish the same results. In other cases, connecting a condenser and grid leak in parallel and the combination across the accordary, will give even better results. Different values and combinations should be tried.

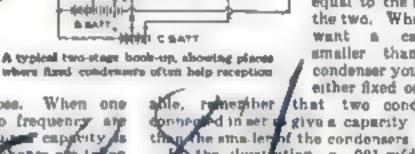
Still another stunt is to connect a fixed condenser between the F terminal of the secondary of the transformer and the filament circuit at the points marked X in the accompanying illustration, instead of connecting the F terminal direct with the filament circuit or the C bettery.

If you find that your 11-plate or 28plate variable condensar does not give the

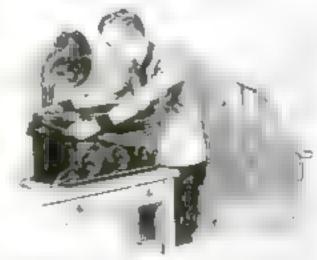
> amount of capacity you require, rememher that when two condensers are connected in parallel the total capacity of the combination is equal to the sum of the two. When you want a capacity smaller than any condenser you have, either fixed or vari-

able, remember that two condensers

connected in set of give a capacity of less than the smaller of the condensers in the dissertation a .001-mid. condenser percent the secondary was obtained by connecting a .0005 fixed condenser in parallel with the 23-plate condenser whose maximum capacity was .0005 mfd.



Slip-Cover Keeps Dust from Radio Receiving Set



STANDING idle much of the time, the ordinary radio cabinet and panel constantly are in need of dusting. The polished surfaces seem natural dust collectors. This can be overcome by making a slip cover of imitation leather or cloth similar to one used for a typewriter. Shits may be made for the wires.—DAVID COUTTS.





Radio & Audio Frequency TRANSFORMERS

"The Heart of a Good Receiver"

EQUAL to the widest range of reception requirements, Marle Transformers amplify the weakent broadcasting, over frequencies all the way up to 3500 cycles without variation Perfect tone quality. Utter absence of bowling or distortion. To get the most out of racio-use Marle Transformers.

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Orange New Jersey

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Radio F ypee R1 and R2 \$4.00

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Write for Free Calabogue of MONARCH Lather which are built up to 30-inch ruring.

THE MONARCH MACHINE TOOL CO.

Glass Push Pins Serve as Knobs for Smaller Drawers

WHEN constructing homemade furniture, it is not always easy to obtain suitable knobs for small drawers, yet 🚅 knobe must be in harmony with Are design of the article or the work w 1 present an amateur appearance Gass push pins make of thenter ous for such drawers.

The pina Te at the ed by Juriang them into the drawer

If the front from. inthi reflough, the plant of the pin can be chucked mer: if it is too thick, hore a hole partly through the back, as indicated, to make a thin place in which the pin can be clinched. Anneal the point in a flame before clinching H P. CLAY, Kingsburg, Calif.



Profe pin mod as e drawer knob

Punching Holes in Sheet Metal

THE perforated sinc drum of our washing machine broke in several that ex recently and had so be recommended Then was done by apply a shootlef on our, to whe will higher were fit about by the supplemental the subfruit crains by used the full rat salating thin sheet metal.



filmply punch die

The die plate is a length of 14 by 114 in, bar iron about 236 times as long as the width of the sheet to be punched. The bar is beated, folded as indicated, and drilled with holes through both upper and lower

arms. The punch is simply a machinist's pin punch of the same size as the hole; it has a long shank and is hardened.

The sheet to be punched is laid out with a scriber and centers are marked with a prick punch, so that they can be seen through the holes in the stripper plate The wear on the punch is hardly noticeable.-Hanny W. LEUTSHER, Baltimore, Md.

Linoleum Table Tops

OR some purposes a table top covered with cork linoleum has advantages over either wood or porceluin. In one instance I glued a sheet of green cork linoleum over a



XXZ FRAME-

foundation of in in ward and trimmed the dages with with 4 STOTI GOOG Thy 2 m ram of the fas then made and down no the mr. I sed to place to markie or the top of a washinganishis was found very satisfactors .- A. D. K. DEWET, Newcastle, Natal, S. Africa,



Here it is

Your odd-job helper!

THESE are the days when odd jobs popup and your spare time is profitably tilled in doing them.

You's have to cerehaul your cor and per it ready for summer service. Task PRI NTISS held the work so you can have V.5F

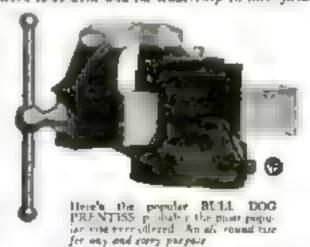
You'll want to fix the occeen doors for the flyweather that a arriving and hand comething for the house. The PRINTISS VISE will serve as a never-in any he-per-

You'll want to scrap that "one lung" radio and build a RFAL set with lots of DX and everything. Put the panels in the vise when you are ready to saw or polish. Fine for winding coils, too.

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The two-piece crank set and two-point half bearings will outlest any other type and make pedating early or walking.

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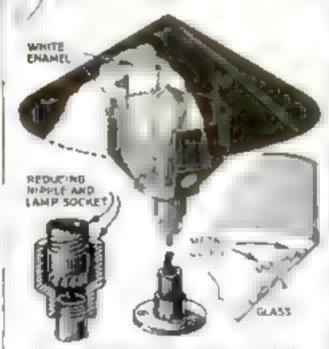
San Francisco: 717 Mariet St.

VER JOHNSON BICYCLES

Indirect Illumination at Bench Prevents Eye Strain

FOR the home worker who spends dany evening hours at his bench, croper illumination is a detail of considerate unportance. Practically all bloches are fitted with some form of open or partly shaded dropaght, and the cirect rejection from the polished surfaces of tools and materials is trying on the ey

Indirect lighting, which has given such g now as staction in other applications, installed above the workbench se it is not necessary to provide an apprate or ornamental fixture. The



Improved beach lamp stand and shade made mainly of pape fittings and short metal.

fixture shown can, indeed, be made up from simple materials and tools in an hour or two of space time.

The base is a pipe flange; the support for the light screws into this and connects with a second flange above shaped holder as riveted to the upper flange and serves to shroud the aight. In this bowl, several large holes are made and circular sections of frosted glass are secured behind them with small metal A lamp socket is screwed either directly to the top of the pipe forming the support or into a reducing nipple fastened

The main reflector is a flat, cone-shaped cover, with three wire legs that wedge tightly into the bowl. Being detachable, it allows the easy removal of the lamp buib. Both bowl and reflector can be made of sheet tim: the supports and fittings are ordinary wrought-iron pips. The inside of the bowl and reflector should be painted with white enumel, preferably baked on .- G. A.

Repairing a Garden Hose

LEAKY or peeled spot in a lawn A hase may be repaired by contag it with one of the turry prepara plied to paper roofs, The bose said the thoroughly der to mant will a heated into readily after the unplication has dried, which which is less than a in nute, and more preading it with a plathie stick, time, free or six coats have thoroughly scaled the porous spot. Take should then be winapped around the apply to protect the hands and keep the rotif paint from chipping of -John L. Doughnay, Toledo, Ohio.



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No other light passence the wide range of eaght dewing according provided by



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No other light so quickly and deministry gars the right of way, for a three-way light rays are always exceptioned and abound. Installed on the

lafe running coard, the green light of Auto Pay prevages ands two ping and callings, while the two tight whind and the white light on the road, shows asact safety electrical to passing curs

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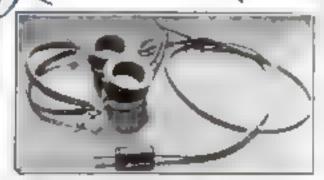
A practical treatise on electrical calculations of all know reduced to a series of rules all of the samplest forms, and involving only ordinary withmetic. 200 pp. Price, \$1.50.

POPULAR SCIENCE MONTHLY 225 W. 39th St. 11 II NEW YORK

Flexible Tube Keeps Phone Cords from Kinking

A LMOST overy radio for is annoyed more of less with tanging and kinkadultion for this problem by sulling the telephone card through a section of fire-

1



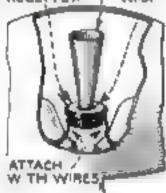
Rubber or flexible metal tubing slipped over telephone cords prevents wires' tanging

ible metal tubing, such as is used for small gas-stove connections. Rubber tubing probably would have done as well. The same device in equally useful for preventing the electric from cord from becoming tangled,-HARRY SCHULTE, Astoria, N. Y.

Library Lump Loudspeaker

TABLE lamp with starge domest shaped glass thate makes an excellead adio londspenier. Attack a cardunit with glue of coding was. Fix this lothe state us indicated so that the mouth

CARDBOARD TELEPHONE SEALING RECEIVER WAX



Lotelapeaker Festenek under a glass dome

of the horn is about 2 in. away from the top The length of the horn is determined, therefore, by the space avallable in the dome above the lamps. It need not be very long. so the dome will do the greater part of the tone amplification.

The horn should not taper

too much and the smaller and should not be larger than the hole or holes in the earpiece of the phone. Experiment by moving the horn up and down until it is located no that the sound waves apread over the expanding surface of the shade.

One advantage of this loudspeaker is that it distributes the sound all over the room. It reproduces speech, music, and code without distortion, -D. McINTYRE.

Ring Clip Adjust Length of Electric Drup Cord

N ORDINAR! CHES of play aser to find built of to electronic in for the his the core tirming a doro-**CBS**5 muthod of hooking It fover a pail or, if the clip is sprung



out, over some part of a bedstead or other piece of furniture. -HAROLD E. BENSON, Boulder, Colo.

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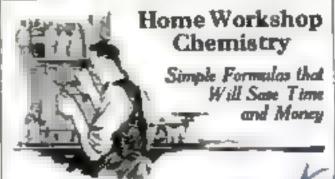
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NO HOME should be without have stant use. When a fire starts—and now adays there are many tre hatards in each. the best administered from everything depends upon the apped with which the blass is attacked at is all en well to count on the fire department's turning out within below minites. One or two minute at the start often makes all the difference between a trifling and a disastron fire

Prigunately it costs little in time or many to provide fire-extinguishers and ratios to hold them. They should be placed at points of danger-beside the



If used quickly enough, howeverede fireextensioners will put out almost may fire

furnace in the cellar, in the kitchen, alongside the home workshop beach, and near stairway landings.

Fire-extinguishers, both liquid and solid, simply smother the fiames by preventing the air from reaching them. The flames from both burning liquids and solids are due to ignited gases, and these gases require oxygen to support combustion. As soon as the fire is deprived of its oxygen, which is taken from the air, it goes out.

For this reason it is only necessary to add to an incipient fire certain types of chemicals that will remove all available oxygen from its immediate vicinity. A number of these are known and some are quite important. The most universally employed is the liquid carbon tetrachlorid (a well-known closning fluid is practically the same thing). The liquid usually is sprayed 90 the fire

Another method of using carbon tetrachlorid on a fire-extinguisher is in bombs. These are most conveniently prepared from burnt-out electric-light bulbs. Fill a dish-which should not be too shallowwith carbon tetrachlorid. Then take one of the old bulbs and a pair of pliers, dip the tip of the bulb into the liquid, and carefully break off as amail a piece of the tip as possible.

Since these bulbs are highly evacuated, the pressure of the air will force the liquid

(Contenued on page 110)



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Leonal it. Make Donne an. But have store 10-day trial. Bend on receiver.

Bend on receiver.

By this worderful short-out method Marshalf Sistiman receives you have to hit gayed duck after he from ourse distance in the time adequiposally. It is not be suggested in the start of leasting combining the riseweet blows used to the single mention for developing wind mared and couldened.

Bend on the single mention in the developing wind mared and couldened. We want have be distant as anothered when to there have be distant as appearant how to there have be distant as appearant how to there has a let gaste you friend behind how a licensk in a rangle hand he as it. The following of Schools W. It his manner on proceedings to the latent had be a supply of fathering of Schools W. It his manner on proceed a description of the Leon see fatge. Father with the half about high is not the Leon see fatge. Father with the half about high is not the Leon see fatge. Father with the process Loungary Colleges to be seened to be seened to the seened to the position. The means he source to done in the seened to the positions. Then means he source to done in the seened to the positions. Then means are source to be an appearance of the seened and source had a man only as whether the contract manner of the seened source. The seened and source had a man of the Mall the company of the life of the seened and with all the contract manner of the seened source. The seened source that the Mall the company of the life of the seened source.

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Home Workshop Chemistry

Continued from page 118,

into the bulb. In other words, the fluid is sucked up until the bulb practically is filled. Lift it out of the dish and place it, tip up, in a holder or rack. It is best to seal the tip with sealing-wax or wax, but take care that the fluid does not come in contact with and dissolve the wax

Hang a rack containing several of these bombs in one or more safe and easily



accessible apots. If a fire starts, burl bombe at the worst part of it with suffcient force to break the glass.

Carbon trachlond

perhaps the best type of extinguisher for firm of electrical ខ្មាញកា chemiwhere cals that conduct the electrical current would make the lire wome and



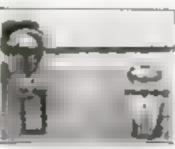
Filling on old electric stath ... وسفا car bon tetrachland

might be fatal to the user. It produces a gas beavier than air, which blankets the fire when the fire is near the ground or some level spot, even such severe firm as those produced by gasoline, alcohol, and

turpentine

Liquid-filled hand grenudes—that is, old electric-light bulbs filled as described, but using water in which such chemicals as sal ammonue, borax, calcium chlorid, Epsom salts, and the like are desolved. also are in common use, but these are of value only when the fire is still in its first stages and has not apread too far. A solution of 20 oz. of calcium chlorid and 5 og, of table salt in a little more than 12 gal, of water, is quite effective.

Homemade powdered fire-extinguishers are not of so much value to the householder, although they do perform excellent service in the laboratory where a fire usually is local and no more than 1 or 2 it. in diameter when in its first stages. Of all powders, sand is the best to use on a chemical fire, but a mixture of equal parts



One easily made type of bomb rack

of common table salt, sal ammoniae, and bicarbonate of soda in 2-qt. wide - mouthed pars, is also good if a large box of sand is not available in the laboratory

A few years

ago, while making benzyl-benzoate, the flask containing metallic sodium dissolved in benayl alcohol broke into spontaneous combustion while pouring this hot mixture into bensaldehyde. The flask broke, scattering the flaming chemicals all over the laboratory floor. Sand and dirt were thrown on the fire, which flickered, smoked, and was out. The floor later was found to be covered by less than M in, of sand, but this had saved the laboratory

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Count the production, aim at an increase —and you manage to get the increase!

"Easy going" or under-developed machines need a production-goal. The goal may be set and the standard met, with the aid of a Veeder Counter.

You don't know what your machine can DO, without watching its record on a counter. You don't know when it's mechanically right or rightly non-without the result-record on a

The small Revolution Counter below registers one for a revolution

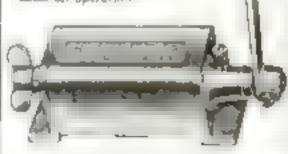
of a shaft, recording a muchine operation, or product sman, thus counter a very durable;



tto mechanum will stand a very high rate of speed, making it especially suitable for light, faut-running mechartes and most adaptable to esperimental work If gun backward the counter sub-

tracta. Price \$2.00. (Cat 6-5 size.) Small Rotary Ratchet Counter, to register reciprocating inovements of small machmes, slep \$2.00,

The Revolution Set-Back Counter below records the output of the larger machines where a shuft-revolution indication are operations.



Sets back to zero from any figure by turning knob once around. Supplied with from four to too future-when quired. Price with four figure-wheels as illustrated, \$10.00—subject to discount. Cut less than one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, \$11.50 (list).

These counters and others for every possible need are shown in the Veeder booklet-an 80-page free guide.

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It's So Simple— Your Boy Can Do It

It's fun to repair putictures— if you use a Shaler. It a the easiest and best way, too, because Shales Het Parches" are head-vulcan sed to the tube so that they can't loosen or come off. It's so simple that your boy can do it

To make a permanent repair merely. clamp a Shaler Patch-&-Heat Unit over the puncture, out or teer and light the mod less it contains lika-tly enought hear is generaled to vid at se the rabber. A ser or a mentes take of the pan and the w (tuwny That sail. The tube a really to use. Anyone can do it arywhere. Nagasol e. no ce e t -no danger of burning the tubes.

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Millions of motorists carry the convenient Shaler Vulcan rer in their cara, They like to be I their friends. about it and they can hardly underatana why upperhere we says should ever want to be ther with " stelling. on" cold patches that soon lower and corse filt a term to sub-easier to "vulcarize Firefund topice it Last.

Costs only \$1.50

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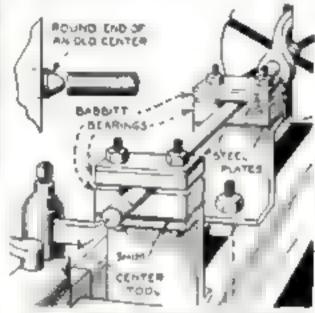


Centering Small Lathe Work Exactly

By Howard Greene

SMALL shaft that is perfectly plain and of the same diameter throughout most of its length is often needed in mechanical work. It may, perhaps, have a shoulder at one or both ends, or a reduced part somewhere, but the plans part of the shaft must be accurately concentric with the reduced parts to insure true running. Usually the many that the whole shaft has to be worked down in the lathe from a niercof comparatively heavy stock. If the shaft is long and light, thus blikely to be difficult because of the taxon to be difficult because of the tendency to apring, to say nothing of the tiple and trouble involved

To maker a small shaft with sufficient accuracy so that the reductions can be made and the rest of the shaft used with-



Mounted in two boaring-like ettachments, shaft can, be centered occurately

out turning, is extremely difficult if the ordinary methods of centering are employed. By the use of the simple attachment described, however, centering can be done with such accuracy that it is necessary only to select a piece of shafting or drill-rod of the requisits size for the body of the shaft, center it in the attachment, and then turn the aboulders or whatever is necessary. The result will be a shaft at least as good as if turned all over, and probably better, especially if the shaft as light and springy

The idea is to center the shaft while it is revolving in bearings, and to mount it so that the lathe tool can work on the end. Make two brackets of cold-rolled steel; the dimensions depending upon the dimensions of the lathe you use. To the under side of each foot rivet a brass block that will fit enugly between the shears of the lathe, and fit a holding-down bolt in any way that the construction of the lathe will permit.

THE two larger blocks at the top of the bracket are of Babbitt metal, the lower one being notched at 46 degrees, and the upper one plain. Two machine screws pass through clearing holes in the bracket, are tapped into the lower block, and run through clearing holes in the upper block. Above is a steel plate, against which the nuts hold, as shown.

By this arrangement the lower block can be adjusted to any beight within the range of motion of the acrews by turning the acrews with a acrewdriver, slipping packing strips under the block, and tightening the acrews. The cap is tightened upon the shelt by means of the nuts.

The night-rings notch in the lower block is made of such depth that the smallest shafting to be handled will project sightly above the face of the block when a position in the notch. Shatting of much larger diameter can then be handled samply by reising the

O USE the attachment, set the bracketa on the lathe bod, and with the shaft in position, pack up until the shaft is fairly well centered-that is, until it is at the height of the lathe centers; it does not have to be exact. Let the headstock end of the shaft rest against the rounded and of an old center. Put a dog or driver on it so it will be driven from the inceplate in the usual way. Tighten down the nuts until the shaft will turn just a trife stiffly in the blocks, and put on plenty of oil. Then, with the tailstock pushed out of the way, the slide-rest can be brought up and the end faced off and a center formed with light cuts of a sharp, thin-nosed tool.

When one end is faced and centered, turn the shaft end for end and treat the other end the same way. The shaft can then be placed between centers in the ordinary way and the turning proceeded with, and it will be found to run true to a hair.

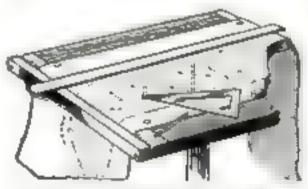
The facing should not be attempted with a tool that has any tendency to dig in. Even for steel it will be best to use a bram-turning tool. If the tool digs in, it will draw the shaft away from its support against the headstock center and make trouble. With reasonable care, however, the method works very well Indeed

Drawing Board Attachment Saves Tracings from Being Creased

FOR making tracings longer than the drawing board, the attachment illustrated is most beeful. It provents tracings from being checked at the right edge of the hoard by the Tenutre.

The right edge of the hoard a rounded and a strip of wood I in require and as

less as the board is wide in fastened to it



The T-equare head skides against an auxiliary strip so that the tracing is not creased

by means of wood screws and two small spacer blocks about 1/16 in, thick and 34 in, square. For greater accuracy and permanency, a steel strip may be used.— J. G. PORREST, South Orange, N J.



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This year you can make your vacation far more es-joyable than last year. Curry one of these small portable radio instruments wherever you go,

Take it with you camping, fishing or bunting, and best of all, when you get back, art it up in your home. You'll enjoy the OZARKA all year 'round.

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How to Build Trellig-Work

(Continued from page 81)

7 by 15 in. The drapery is cut from 2 pieces 1 1/4 by 8 in, by 2 ft, 2 in.

The 4 brackets are 1% by 8 by 14 in. They should be laid out "one in the other" so as to cut without waste. The bracket caps are 114 by 3 by 7 in. For filling

precen under the bottom rail it will be necessary to use 2 sticks 1/4 by 3/4 in. by 2 ft. 8 in. Finishing nails 1 'y and 2 in, long are used throughout

The screen shown (Fig. 2) in a much more substantial trellie and includes a seat and a garden gate. The trellis work on each aide of the gate usually is made alske, but two designs are given so as to allow ample choice on the part of the builder.

THE post at the extrama left requires 2 atiles 36 by 3 14 in, by 8 ft. 3 in. Between

these attles is named a filling place 1 1/4 by 2 in, by 8 ft. 3 in. The stile that forms the left-hand gate-post requires 2 pieces 16 by 5 in, by 8 ft. ? in., with a filling piece 11/2 by 31/2 in, by 8 ft. 10 in. The vertical muntine are 1 1/4 by 244 by 5 ft. 11 in, and are halved out to sult the rails. which are 134 by 254 by 3 ft. 614 in. (Fig. 5). The curved upper rull is made of 2 pinein cut from atock 34 by 11 in, by 8 ft. 6 in. with a filling piece cut from stock 1 1/4 by 9 14 in. by 3 ft. 6 in. The various other filling pieces required can be cut to Start.

The arch is cut from 3 pieces 15/16 by 17 in. by 2 ft. 8 in., and the 8 arch slats

are 1/4 by 3 by 12 in The meat (Fig. 5), if used, in 1 34 by 16 in. by 3 ft. 10 in., the eest rails 36 by 2 in. by 3 ft. 5 in. and the brackets are out from stock 114 by 15 by 15 in.

The design at the right of the gate (lower view, Fig. 2) makes use of a trelliswork of 1/2 by 2 in. sizts, and therefore the construction of the posts is modified to stut, as in Frg. 4. Each gate-post is

made up of 1 stile 134 by 6 in, by 8 ft. 7 in., 1 stile 34 by 6 Fig. 5. Construction in, by 8 ft. 7 in., and of the nest and a filling piece 1/4 by beavy trake-work 4 in. by 8 ft, 7 in. Each outside stile, such as at the right,

in Fig. 2, requires 1 piece 11/4 by 4 in. by 6 ft. 8 in., 1 piece 34 by 4 in. by 5 ft. 8 m. and a filling piece 1/2 by 3 in, by 5 ft. 9 in. The bottom rail requires 1 piece 134 (Continued on page 122)



Fig. 4. Deted of arch. and light plate.



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-when you use "Yankee" Ratchet Screw-drivers on them. Every motor mechanic, car-owner who does his own repairing, knows how long it takes to overhaul a magneto.

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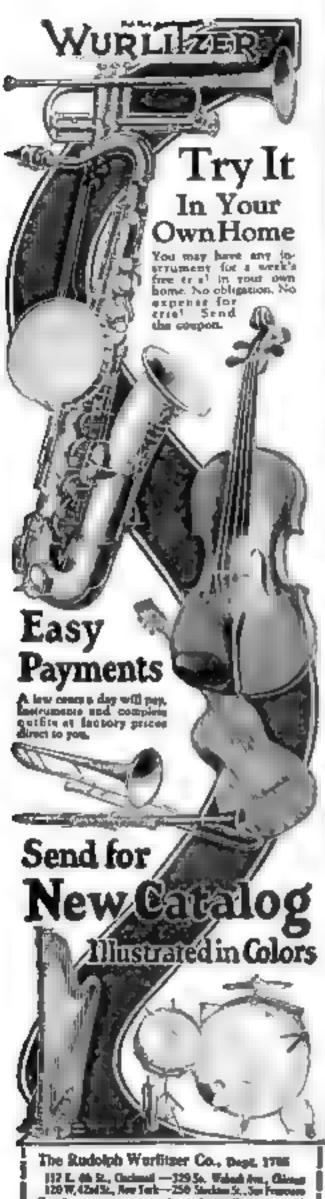
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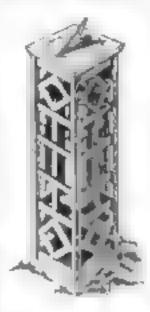
(Same represented in Subject of the Party of the Control of

How to Build Trellis-Work

(Continued from page 121)

by 3 ½ in. by 3 ft. 7 in., 1 piece ½ by 3 ½ by 3 ½ in. by 3 ft. 7 in. and a filling piece ½ by 2 ½ in. by 5 ft. 9 in. The top rail requires 1 piece 1½ by 10 in. by 4 ft. 2 ½ in., 1 piece ½ by 9 in. by 4 ft. 2 ½ in., and a filling piece ½ by 9 in. by 4 ft. The cap is ½ by 5 in. square. The details of the gate itself are sufficiently indicated in the drawing.

The fan trellis shown in Fig. 3 requires 15 pieces 1/2 or 1/4 in, thick, 11/4 in, wide and 9 (t. long. These are bolted together at the bottom with 3 long 1/4-in, holts. The entire bundle, held securely together, in then bored with 1/4-in, holes to take the six round cross pieces, which are 1/4 in, in diameter and 1/4 ft. long. These are soaked in water for at least 2/4 hours and





Pig. 6. Ornemental sum-dial. Two strips are solled on the janute corner of each post and the decurative filler strips are "toe-nasied" in place

then slipped through the holes. It is then possible to bend the strips facilite, as shown, and to drive a '1- or 1-in finishing nail into each intersection. Four anchor pieces 36 by 6 in, by 2 it. 6 in are nailed to the bottom edges of the vertical members and buried 6 in, deep in the ground

THE sun-dual (Fig. 6) is not hard to build when once the construction is understood. Each post, which is 1% by 1% in, by 4 ft is in, has naited to its inside corners 2 strips 1% by 2, in, by 4 ft and to these strips are naited the ornamental trellis-work. For a distance of 8 in, the posts are buried in the ground or set in concrete. The sun-dual can be either a homemade one of wood or metal, marked out by experiment to show the time of day, or a purchased dial

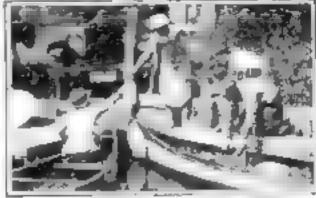
The completed trellses usually are painted, but they may be stained or even allowed to weather naturally, if preferred

Trellia Blueprint No. 34

Fifth working details and complete bills of material for trellisms, such as described in the foregoing article, are contained on Blueprint No. 34 of the Home Workshop minus. This may be obtained for the nominal price of 25 cents to cover the cost of blueprinting, handling, and mailing, from POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York.

Among articles scheduled for early publication in the Home Workshop Department are "Valuable Antique" Chair Made with Ordinary Hand Tools," "Playing Water Polo on Aquate Ponies," "Constructing a Rustic Summer House," etc.

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Enlarging Outfit Is Mounted in Door to Save Space

LACK of room prevents manylamateur photographers from on arging their negatives. How the writer overcame this problem may help others in the same

After he enlarg manara. built . pinded OD the ck the door an attic room on we hooks acrewed into the door, but not far enough to go through on the other side. enlarging board, also suspended from books, can be placed at various distances from the lens so that prints of different pizes can be produced.



The unlarging patrick in use

After use the unlarging board and

camera are unhooked and set away.— GEORGE HENDER, Jersey City, N. J.

Mercury Is Used in Making Unique Adjustable Grid Leak

OFTEN the radio fan who has to make his own apparatus party and the state comes to preparing an a carate are contained and care matter, however, nest a gristiant care to make that well give processing the contained adjustment as precessing to make matter, and account of the contained circuits.

The container is simply a glass tube

CORM
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Tilting the tube varies

with two corks. Prepare a small strip of Bristol board to fit inside the tube and give it two coats of ordinary India drawing lak. Wind a piece of bare copper wire around the

end of the strip and slip it through the heat in one of the corks.

Another piece of wire is pushed through the hole in the other cork so that it projects a trifle inside the tube and a few drops of mercury are placed inside the tube. Then, when the leak is tipped, the mercury covers or uncovers the carboncoated paper and consequently alters the resistance.

The tube can be placed on the end of a brass rod and turned by means of a knob from the front of the panel. Use ficable leads for the connections.—Carrer Frank.

Any one who has tried to cut sheet celluloid knows it is not as easy at it looks. The best way is to make a deep scratch with a sharp scriber or the like and sheep part the charmed by berthan it sharply along the scratch. This trick anisolal/particular y when custon or irregular shapes have to be out.



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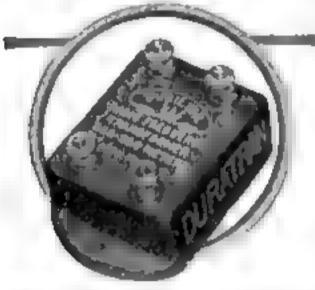
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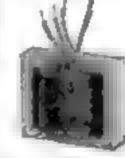
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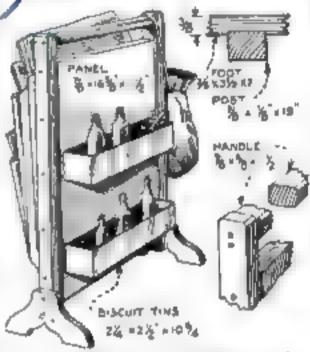
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The stook should be hard wood. If a d 16% in, wide is not obtainable, glue



The redside stand, with dimensions and details of the foot and handle construction

up the main panel in two pieces. Cut this and the handle square and true and exactly the same length, then neil the parts together, being careful not to split the panel. Drill small holes first if the wood is very hard. Cut the feet as shown and notch or dado them to fit the battens and sail or screw them on

Buscuit time, of the kind commonly used for crackers of good quality, serve as the small trays shown. A screw at each end holds them in place. It is well to paint or enamel the time before fastening

them on.—A. E. E

Holding Awkward Work in a Machinist's Vise

TWO thin pieces of wood placed in machinust via an about at the left and of the accompanying dilustration will form a rest for the work that other or work that otherwise would be awke ard to hold If much work to be handled is well to

ANGLE WOODEN PIECE



Two time-seriing whee kinks

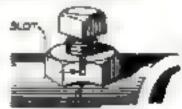
nerew brass lugs to the enda of the keep Vise jaws ! the wooden supports in place, or they can be bound on temporarily with wire.

Rectangular work that has to be held by the

corners can be handled by using a support made from a short piece of flat iron bent at a right angle, as shown in the righthand view. The sharp outside corner of the angle iron should be filed off. If the work is deheate, a similar piece may be med at the other side to protect the opposite edge.-CAPT. E. A. McCANN.

Grip Nut with Concave Face Locks Setscrew Tightly

SETSCREWS in pulleys, gears, and similar shaft-driven parts that have murked tendency to work loose, can be



ETHNO CONCAVE

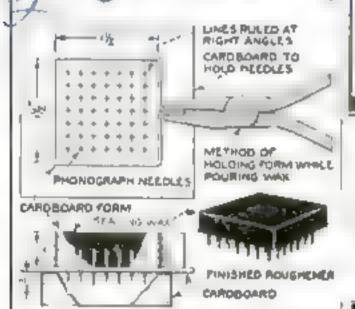
locked tightly with a small nut med fied as shown.

The nut is held against a greatern whee, and the bearing face is ground a traffe to make the centre concave. To apper side is their signed as advanted. When the nut is tuntened, the presents on the face courses. acrew rigidly,-G. A.

Phonograph Needle Tool Will Remove Bloom from Rubber

N EFFICIENT roughening tool to A be used when vulcanizing new tubes or rubber articles, can be spain. from phonograph negligs beid in seal 🚁

Rule on a piece of tardiscard writes seven light that cross such gater at right printed about 8/16 in. apart. At each



After being driven partly through a cordboard form, the needles are held with was

1

intersection a needle is pushed through the cardboard, projecting about 3/16 in. on the other side. A cardboard form then is held above this, as shown in the filustration, and filled with sealing-wax. When cold the cardboard can be trammed or sonkedfoff and the sealing-wax will hold the needles firmly in place. This is far superior to the perforated tin tool usually used,-Francis G. La Merle, Washington, D. C.

Drilling at an Angle

T IS pert to impossible at those to start a drillat un angle fi methi. Thun first drilling a shallow hope straight little the piece with a



Starting the drill

larger drill and using the conical surface formed by the drill lip angle as a place to start the emaller drill, as illustrated -H. S. TRECARTIN.

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Shipshape



Doors that Bina

NOT always is the PROCESSANT, AS SOME people supposed to dress the edge of a

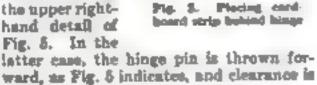
door or casement wandew then blads Other methods of faming it are possible, and the use of the plane should He resorted to only when those expedients have fatigi

Sometimes, because of too frep seating of the o over, additional coals of paint,

or this we do of the stile, h door Becomes hinge bound hings classes in too swall so that the hinge strikes the jamb before the lock bolt engages. This ptrains the hingen and causes trouble.

The remedy is to remove the screws from the jamb side of the hinges, one hange at a time, and

place a thickness of eardboard behind the hinge. The same effect is often more casily obtainable aimply by loosening the screws and slipping a narrow strip of cardboard between the hinge and jumb but in front of the acrews, as Illustrated in Fig. 1 and shown in the upper righthund detall of



given to the door Swelling of the door or settling of the building may cause the door to strike on the front edge. If there is more than 1/16 in, clearance on the hinge edge, reverse the treatment described above; that is,

slip a cardboard strip between the hinge and jamb, but behind the screws, as in Fig 3 and the lower right-hand detail of Fig 6 By thus reducing the hinge clearance, the lock edge of the door often may be made to clear the jamb sufficiently.

If the door strikes

by tards above the lock, an inspection of he large cleanance may show that the poper tringe scriws have loosened, allowby the door to may The remedy is to

77₁, 1

žrom.

serting thus

front.

tighten them again, or, if the holes are worn, to drive wooden covered pegs with glue into them and replacethescrews. If the hinge is firm, try reducing its clearance, as in Figs. 3 and 6. Manipulation the lower bings is equally effective when the

door hinds below the lock. All of these adjustments

can be made without removing the pine from the hinges or taking down the door. If they fall to remedy the trouble, planing must be rewarted to.

When dressing the upper end of the hinge stile, round the edges slightly to prevent splintering, and push the plane toward the hinge. To dress the stile above the lock, use the plane as in Fig. 2. If the door must be

dressed for its full length, remove the binges, as that is easier than taking off the lock, and the bare wood on the back edge is less noticeable than on the front. The chloried recourse for the hinges must then be despened as much as necessary to allow the hinges to set flush as before.

When unevenness of the floor causes the bottom of the door to rub, the door may be cut off sufficiently to clear, but a better way is to set the bottom hinge forward 1/2 in., as in Fig. 4 and the left-hand detail of Fig. 5. Another method is to replace the hinge with a wider one so that the pin of the lower hunge will be further



Setting the Fig. 4. lower hinge forward

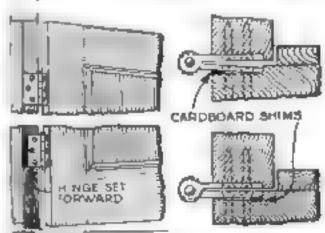


Fig. 5. Three ways of adjusting hinges to prevent doors from blading at bottom or sides

The Shipshape Home

(Continued from page 126)

in front of the door than that of the upper. Figure 5 llittstrates the principle of this adjustment.

Reseating Porch Chairs

A BURR - BOTTOS porch chair need no be discarded simply because the botter

is broken. A very g bu sayst othe mak he made of webbing, which odo be bught at any harness of a and comes of several

The object of estrated, which was re-sented with did objec webbing 1% in.

with a had not n in use for two numbers and has proved rempletely antisfactory

The webbing ahould b e passed around and around from back to front and drawn an tightly as possible until the space is filled.

Tack each strand securely on the under



Porch clusir reseated with blue webbing

side of the chair at both front and back before pulling the next strand. When the space is filled, cut the webbing and secure the end on the under side. Then weave, banket fashion, from side to side, pulling tightly as before, and tacking each strand. Weave on the under as well as on the upper side.

When completed, the chair really has two woven seats with a small space between. This makes a seat both strong and lasting, as well as one that looks well -GRACE R. SCHOETTLER, Buda, Ill.

Locking Screw Hooks

OUTSIDE screens are humany u partt Marcel Pro-law or

the bottom with seres fromks at Jayes. Quite often chatters staying at a wir dow will undo the books and bush out the

To Arivent this, belinply twint blook Berghaups of th Distance of the hypep of the books as shown This locks the hook in place.-LOUIS SCHNEIDER. Chaton, Mo.



Trimming Wallpaper

ONE of the most tedious tasks walipapenng a roo is to take the selvar

edges. If you hold the paper southat the light from a window of a lamp will share through from the other side of the paper, you can followeasily the straight edge of the pattern with your allears, because it will show the straight edge of the pattern with your allears, because it will show through. -A. M. SMYTH.

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R. H. FRAVEL, Patent Lawyer of the B. H. Peters Office Examining Corne Room \$503 McLackian Mag. WASHINGTON, D.C.

Flooring Strips Used in Building Neat Radio Antenna Mast

MAST 25 ft. high for supporting a A radio antenna can be made of four strips of flooring, each 13 ft. long and 3 in wide. In the installation show, the zerial is of the umbrella type so that the wires act as stays, it has poved very satisfactory in action service and, printed white, it lights surprisingly well—even better than a regular one piece must

Two of the strips to bolted together at one end offer two V-in carriage boits, the first J in from the extreme end and the other 6 in from the first. The other two

Ö

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Mear of Bouring for

an numbertile serial

Q.

unds of the two strips are spread apart and 1 wa paces of 1-10 wood are nailed to 1 ft apart Theb two similar strips flooring are holled outside the first with light carriage bolts running clear through from side to side. Two bolts are used, placed as close as possible to the spacing blocks. When these are milled up tight the joint is stiff und strong

The lower ends are spread apart about 3 R. and bulted to blocks,

which are bolted in turn to a piece of 1-in, lumber about 6 ft. long and 10 in wide. Two bracing blocks are nailed in halfway between the bottom and the middle joint and halfway between the joint and the top. In putting them in, make them wide enough so that they will have to be forced in place, slightly apreading the stripe apart.

There should be washers under all bultheads and nuts, all nuts should be pulled down as hard as possible without splitting the wood; and the wire stays should be attached in such a way that they cannot cut into the wood. A simple way to attach the stays is to hook them over a long bolt that has been run through the top of the mast and clamped in place with a nut and washer on each uide,-H. G.

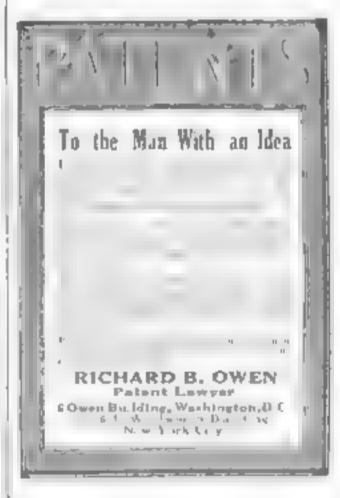
Soldering Small Objects

X/ITH a pair of pliers and a gas-stove I have soldered very small parts together easier and more quarkly than

To solder an upright mere to a flat piece, for example, clean and app of flux an the usual way, but he parts an expect relation to each other, place fragments of solder against the point and then, with the filers, half the parts over the gas flame for a moment. The solder will melt and flow into the joint

/ Flat pieces are joined by placing a top of solder between them, heating them over the fiame and pressure them together with the pliers. Provided heat will not hurt the parts, this is often a convenient method.-E. A. M.







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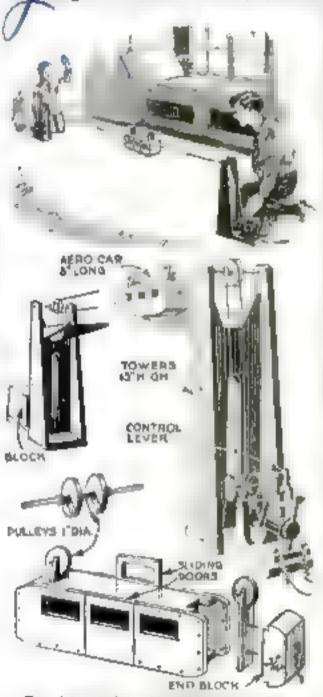
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Miniature Aero Car Driven by Toy Electric Motor By Donald W. Clark

OW that aerial cable cars are being given much publicity, as in the description of the Chamonix line in 🧀 month's POPULAR SCIENCE M NTIFY, boy engineers will find the building it toy aero ranway a fascinating problem.

The zero car and the two trivers to support the cable are built mainly of the wood, that taken from packing other at cigar boxes will do nicely Zho cable motor of any type playedes the power,

The car is 15, in wide, 21, in high, and long. The ends are two blocks cut



Boys interested in the striking cover of the April number of Popular Science Monthly will enjoy building this serial railway

out like the one shown detached in the lower part of the illustration. The top, hottom, and aldes are 1/2-in.-thick wood. The pulleys, which are I in in diameter, are merely grooved wooden disks on wire axles. Each is mounted in a slot in a piece 14 by 7, by 314 in, which is nailed to the end block, as indicated.

The sides are made at first as if there were no doors. In assembling, however, no nails are driven where the doors are to be cut out. It is then possible to cut the doors through with a backsaw or a sharp penichife, making the cuts at a slight angle like a dovetail This allows the doors to alide up and down. To prevent them from falling out, a small piece of bram or tin is

(Continued on page 130)

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I NOTE THESE 7 SIGNS IN MEN PAST 40

By Byram C. Kelly, A. M., L. L. D.

I am past 40 myself. I had begun to wonder when I would begun to break—to lose my old-time pep and aggressiveness—when, through a mutual friend I made the personal acquaintance of a certain member of the American Association for the Advancement of Science, whose wonderful work I had heard of. I made a trip to his laboratories and the things I learned should interest every man approaching or past the prime of life. Surprising as it may seem, hearly two-thirds of all men past a certain middle ago suffer with a disorder of the prostate gland.

Common Middle Age Ailments

Here is an important cause for many conditions which heretofore have been taken for granted as old-age adments—sciation, aches in back, legs and lest, frequent mightly risings, hervoussess and crutability and frequent dirry spells, indicating high blood pressure. Constipation, headaches and depressed spirits often go along with it. But my visit would have been in vain had I not learned of an amazing treatment that resches this gland directly—and is so convenient that anyone can apply it in his own home.

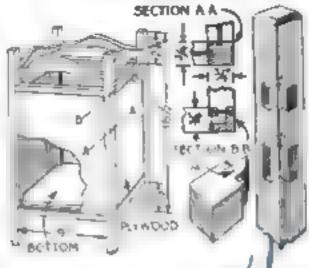
10,000 Men Find Relief

I know too plainly the effects of prostate gland disorder when it is allowed to continue tranbated. I know of the operations and the common saying among many that the average life after this operation is only two or three years. That is why I am doing everything passible to let people know of this important discovery. Statemen, bunkets, lawyers, doctors, men from every walk in life have used the method with success. I have send hundreds of letters from gratified men. remember in particular was from a Colorado man which says, "73 years young is my age. Vet for years I suffered with prostate trouble. Used medicine to no avail had about given up hope when a doctor recommended your treatment." Just think of a man 73 years old stored to the hearth and buoyancy of youthwithout drugs, electric rays or books.

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If you have prostate trouble, if you suffer with any of the ailments mentioned above, you should not lose a day in finding out about this wonderful new method. Send immediately for an interesting, free book called, "Why Many Men Are Did at 40." It describes this splendid treatment and shows you how you may regain much of your youthful vigor Send your request to the Electro Thermal Company, 4031 Main Street, Steubenville, Ohio, the concern that is distributing these books for the author. There is no obligation. If you are not in crested yourself you may be able to do an older friend an unineasurable benefit by showing him this article.

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any amateur woodworker can make a
wooden waste haper bashet that a both s
durable and attractive in appearance

In this case the posts are leak and the panels of a light-ordered contrasting wood. This posts and rails rould be any dark-polocid wood panels as walnut, or birch or whitewood finished like mahogany. The panels posterably are light oak or birch and center 1/2 or 3/16 in thick. The tenoms are held with bram plus punched below the surface after the joints have been glued up. The loose bottom can be removed quickly for dusting the lower corners.

Miniature Aero Car

(Continued from page 129)

tacked underneath the car, projecting just enough to act as a stop. It is not necessary to make two doors: in fact, the car will be a trifle stronger if there is only one.

The towers are 18 in. high. The main members taper from \(^1_1\) in wide at the top to 4 in. wide at the bottom and are \(^1_1\) in. thick. The base is \(^1_2\) in. by 8 by 10 in. The pulley at the top of one tower is \(^1_2\)/ in, thick and \(^1_3\)/ in. in dispeter. A \(^1_2\)/-in, length of \(^1_3\)/-in, dowed or other round wooden rad is inserted through the center of the pulley to serve as a bearing. The fixed shaft is \(^1_3\)/-in, wire. The pulley at the top of the other tower, which is the motor tower, is made in exactly the same way except that it is twice as thick and has two grooves instead of one.

Note that small metal plates are fastened at the top of the towers to act as

bearings for the pulley shafts.

At the bottom of the motor tower is a countershaft composed of two 1-in. or 1½-in, pulleys. The motor drives one of these pulleys and the other pulley drives the double pulley at the top of the shaft. The countershaft is illustrated separately as one of the details on the preceding page

Three separate belts are used, one connecting the motor and the countershaft, another connecting the countershaft and pulley at the top of the motor tower, and the third, which is the car cable, extending

between the two towers.

Both towers are fitted with bracket-like landing platforms. A block 2 by 3 by 4 in. serves as a weight to hold down the far tower, and both towers can, if necessary, be fastened to the floor. The car is operated by the control lever on the electric motor, which gives movement in either direction at various speech.





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Child's Chair Is Cut from a Single Board

By Homer S. Trecartin

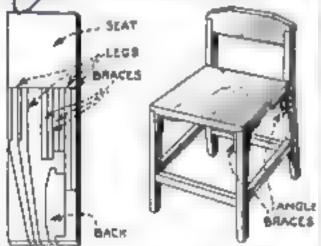
HAD just read an article by a children's doctor telling of the discomfort caused to a child by having to sit on a chair too high for his feet to reach the floor and with no means for supporting them. So I decided to make a comfortable chair for my seven-year-old boy.

Finding no wood around except a 1/4-in. board 12 in, wide, I designed a chair that was made entirely from this piece, and it, has proved properly proportioned for

nas proved properly proportioned for stability and comfort, looks well, is light enough to be moved by the child tramply strong for an adult to use (and comfortable too), and is easily made.

The dimensions I doubt intersection are as follows. Seat, Looy I in toack legs, 27 in long altogether, It in to the seat notch; front lurs, I by 18 in the back rait, I by 18 in over all; front brack, I by III in and aids braces. braces, i will in., and side braces, cut to fit,

The Iront corners of the sent are notched with a Chisal for the front legs, although the legs can be fitted without making even these simple mortises. The



The completed chair and method of cirtting the parts from one wide board

"side braces" are left too long in the layout, as the massest way to fit them is to hold them in position with one end against the front leg, and to mark with a pencil where to cut them to fit against the back

After all the pieces are nicely amouthed with a plane, they can be assembled. If one has a brace and bits, or hand drills, long wood screws may be used, but gixpenny and eightpenny finishing nails will be much quicker. It is worth while to get from a hardware or 10-cent store about eight small angle irons, which should be screwed to the bottom of the seat and to the legs, and under the ends of the legbraces. I have found these fastenings to last better and to give greater stiffness than glued mortise and tenon joints, when knocked around as in a child's chair

Painting or enameling is the hest method of finishing. Contrasting colors, such as orange and black enamel, give a pleasing affect. Be sure to round off all edges well, and to sandpaper everything very smooth, and you will find you have created a lasting treasure for the child.

"HOW to Build a Bunny Rocker for a Small Child," by Kenneth R. LaVoy, and an article describing the construction of a unique gondols swing for children are two of the many play stories planned for summer publication.

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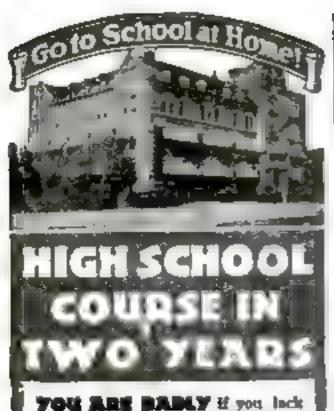
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Underdes Power from the Tides

(Continued from page 30)

In most instances employment is made of "stop-logs" to form a removable dam between two stone piers. When the creek has filled up to the level of high tide, the logs, inserted in grooves cut in the piers, make a fairly serviceable dam, retaining the water as the tide falls. When the tide has ebbed, an outlet gate is opened, and the impounded water is discharged through a wooden flume upon a wooden wheel 18 at 20 feet in diameter

What has been accomplished for so many years by primitive methods and with the help of equally primitive apparatus, certainly can be achieved, in the light of modern scientific knowledge. with the wonderful hydroelectric machinery already in use.

THE moon is a lazy orb, serving little useful purpose except to give us a certain amount of nocturnal illumination. We have persuaded it to grind grain and saw planks, but it can be compelled to operate mechanical plants on a large scale, It can be made to run the machinery of our factories. Bluminate our cities, beat our houses, drive our railway trains, and lift the elevators in our skyscraper buildings and apartment hotels.

There will be no lack of locations, in estuaries and straits, where tidal developmenta on a great scale can be established. Why, for example, should not the tides of Delaware Bay and of the Cheeapeake be harnessed? Experts say there is no rea-

son why they cannot be.

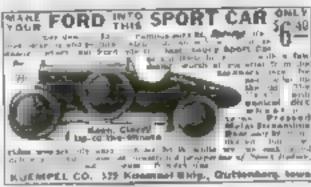
In the meantime, the attention of hydraulic engineers naturally is attracted to places where the tidal rise and full is extraordinarily great. The Bay of Fundy is one of them. Another is at St. Malo, on the Rance River, in France, where the sea, running up a big estuary, gives the waters a 40-foot lift. Another is in England, where the damming of the Severn is expected to yield continuously a power greater than is derived from all the hydroelectric developments of Niagara. In Cook's injet, southern Alaska, the tidal range is the greatest known anywhere, attaining a maximum of 50 feet when moon and sun pull together

MANY years ago, an American warriver, and a cannon, which was being boasted on deck, fell overboard. The American officers, after trying many axpedients to recover the weapon, gave it up. Presently, however, half-a-dozen Chinamen offered to undertake the job.

They fetched a float and tall sheer-legs, stuck the latter deep into the mud of the river bottom, and, at low tide, attached the gun to the float with ropes. The next high tide raised the float, and the gun with it, six feet. The gun was fastened at that beight, and, by repeating the operation again and again, it was soon brought to the surface. Then timbers and more timbers were shoved under the float, notil, with more of the same businem, the gun was lifted to the level of the ship's deck and shoved aboard.

No power? There was unlimited power. All the power of the pull of the moon was available to do the lifting.





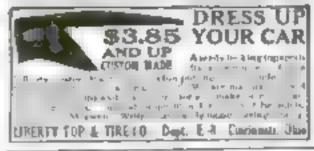
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Can Science Save a Crowded World?

(Continued from page 40)

Centralized distribution of light and heat already has been achieved. All that remains is semi-automatic control for the colossal rabbit warrens such as future apartment houses and office buildings will be.

Fifty years from now, feeding millions in a metropolis will require extraordinary efforts in the way of countrywide intensive farming. Getting food to the man, getting the man to his job, will intensify the pressure on transportation. P. H. Hardin. chief engineer of motive power and rolling stock of the New York Central Railroad. visualizes a new scheme of railway transportation within the next 25 years.

He predicts that the human element eventually will be eliminated. Automatic controls, radio signuls, complete electrification, are some of the stems that will rush the bread of life to belpless dwellers in great conurbations.

WE MAY add that the human element will be eliminated from many other phases of life. The sceman, the gasman, and the milkman all will disappear as did the lonely watcher of our foreinthers who at midnight called "All's well!" In their places will be super-organizations of supply, central heat, and refrigeration.

Indeed, men will live in a super-world Super-power that will save \$0,000,000 tons of coal a year already in Herbert Hoover's pet idea. Most of us will live to see it. It is simply a plan to lump the fuel and water energy of a section of the country and cheaply distribute both in the form of electric current as we now feed light and water to a small community

There will be the super-automobile, costing but a song, that will never need repairing; the super-radio, bringing lifelike tasking movies into our homes; the super-plane and dirigible, both safe and swift. The super-surgeon, who will rid us of our useless organs at both; the supergovernment to deprive us of the morning duty o vivid issued as-

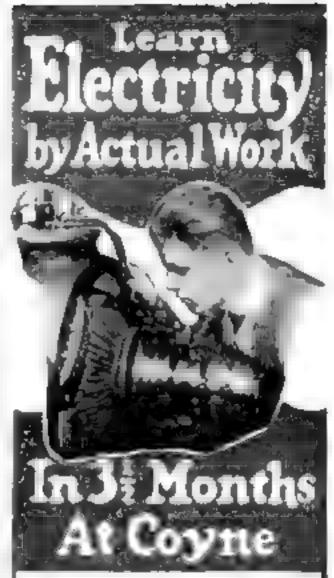
Wars will have become a rare indulgence, disease practically unknown. Medical science, which already has done wondern for the infant-mortality rate and added 10 years to our span of life, will have nearly doubled the terrific acceleration with which population now increases.

THE business center, with its irradiating lines of manufacture and power production, will form a ganglion of intense human toil. Traffic and communication both within itself and to other business centers of the world will be masterpieces of mechanical efficiency

Actual business structures will be skyscrapers from 76 to 150 stories high (one of 80 stories already has been designed). Moving sidewalks, stairs, individual belicopters, all will aid the individual to move swiftly and in comfort within the precincts of his special interests.

Improved methods of machinery and more efficient utilization of the world's sources of power will by that time have reduced the working day to but a few

(Continued on page 134)



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COYNE BLACKWICAL SCHOOL, Pay 33-65 1300-1810 W. Barrison St., Chicago, Dt. Gentleman Please and me free year his estator and year special after of from patrons form.

diddress .

Are pipe-smokers less selfish than other people?

A lot of evidence points that way-maybe some reader can explain it

One can't imagine an ordinary citizen going about telling all his friends where he bought the suit that fits him so well or urging upon his acquaintances the merits of a certain make of shoes—but it's different with pipe-emokers and their tobacco.

Most of them, apparently, won't rest until they have shared their favorite tobacco with every smoking friend.

Read this:

Burrington, Id.

Larus & Bro. Co., Richmond Va.

Gentlemen

I wish a take this opportunity of telling you what I think of Edgeworth. Unto some months and I nowhest after broads of ripe tibucco and never was as infect with any of them never could get any interfaction to on a pipeful. I that the pened upon and asked you to pend menome free samples. And ever since I have been smaking t with great pleasure. At the present time and working with the Telephone Lominary and out of twenty map in the gang it insteen of them smake Figure work now. They power heard of it until I came into the gang. Gentlemen

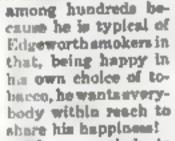
wor, h now long, came and the game. Yours with partifaction, Arthur H. Pfum.

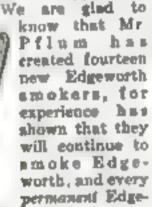
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We'd like mightily to have you pass judgment on Edgeworth. Perhaps you can tell us, then, just what it is that

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Can Science Save a Crowded World?

(Continued from page 137

hours. From this will arise the improvement of replacing the working day by the working interest. That is to say, a man will work three days a week or 10 days a month and be free to enjoy life the remainder of the time. High-altitude commutation planes will transport him to and fro at 500 miles an hour.

The readence suburb of the future will be a vest boulevarded park filled with flowers, amid which dwell the healthy men and women of the future. There will be golf courses enough for all, and playgrounds almost unlimited in extent for pink-cheeked, laughing children. In this section there will be no shops nor machinery nor toil of any sort. Heat and light will be sent by radio from far distant generating stations to all the houses. Simply by pushing a button one will be able instantly to summon such comforts day or night.

EVENTUALLY, the food supply no longer will be a problem of straining every nerve to rush great quantities of inefficient human fuel like meat and bread into the home, for the problem of chemical nutrition will have been solved. Such authorities as Irenée du Pont, Steinmetz, Metchnikoff, and Lodge stready have predicted the balanced ration of synthetic emences that will reduce the volume of food while increasing lumonaely relative nutrition. It sounds like a pretty dull diet, to be sure. But our present menus would look equally uninteresting to the gorging Visigoth.

Steinmets pictured a sort of "bacterial bean"-clusters of microscopic bodies ereating a protein food as alcohol now is made by fermentation. Mr. Du Pont points out that "a mountain of limestons and a waterfall" supply the chemical raw material and energy for sugar and for starch. Luther Burbank promises us strawberries "the size of apples."

A corollary of chemical feeding will be eradication of fatigue. Here again we already have gone far along the way. Fatigue is but a poison. Acid sodium phosphate has been found to be an antidote. A single dose of it will increase a man's endurance 20 per cent.

SLEEP will be more a pleasure than a necessity in the future. Hence there will be no bedrooms, dining-rooms, nor kitchens. Rest will be taken in a secluded corner of the home with talking-movies, opera, and photographic news (up-to-theminute) to make the lazy hour a pleasant

There will be many startling novelties Already in England has appeared the radio-controlled sirplane. By the next generation we shall have the roadsterplane that can be driven to one's place of business and sent back home alone for

There will be items like radio alarm clocks; wireless percolators and toasters; local radiotelephones with automatic control; political campaigns by radlo; pucket movie cameras; communication with

Continued on page 1 15





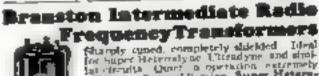




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Can Science Save a Crowded World?

(Continued from page 134)

planets; control of weather; crops that grow avernight; lumber trees produced

In a single season.

Today's untapped sources of power will have been opened. Heat from the tropics may be stored and brought north, The capacity of plants for utilizing sunshine certainly will be turned to human advantage. Wind and tides both will be harnessed. Immeasurable atomic energy will be released.

How fanciful it all sounds! More like the romantic dream of a mind like H. G. Wells'. Yet how cleanly logical in every single Item herein promised for the

future!

ONLY turn back into the past. Think what things were like in 1776, less than 150 years ago. No power, no light. no daily news. No steamships, no movies, no telegraphs. No anesthetic. No electricity. No fuel oil. Why, if a man had dared in public to predict what you and I have seen this day, he straightway would

have been juiled!

And yet, for all its seeming complexity. tomorrow will be an infinitely simpler life than that we lead at present. For we shall have learned our awful lesson of slums and filth and pervous wreckage Such a thing as the human treadmill will be aboluhed forever. Education will have become the popular pastime, and healthful games, with just enough of workdays now and then to keep the mind alert, will be the monthly diet

So shall Science, eventually, thus save us from ourselves. And Science alone shall bring the universal peace we so

pathetically long for now

Finds Diet of Dead Germs Will Kill Live Once

THE possibility of vaccinating against certain duesses by eating the dead germs or cubbing them on the skin is suggested by Prof. A. Besredka, a Russian, working on the staff of the Pasteur Institute, Paris, as a result of experiments upon animals and subsequently with human beings. His conclusions are considered revolutionary in their application to the prevention of disease.

Professor Besredka asserts that immunization is effected by bringing the immunising substances into contact with the tissues where the disease would first enter the body, rather than by injecting

them under the skin.

For example, it was found that guinenpigs could be protected against anthrax. a disease to which they are especially subject, by applying killed anthrax germs to the nurince of the skin where the active

germs usually find lodgment.

Experiments with cholers, typhoid, and dysentery, all diseases that enter the body through the walls of the intestines, have shown that protection may be obtained by administering the vaccines by the mouth, the immunity resulting, according to Professor Besrecks, from the effect of the vaccines on the intestinal cells rather than on the blood.



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The Honey-Bee

(Continued from page 43)

to remove. Still, they cannot be left there to decay, for the bee is a stickler for sanitation. In such cases a sanitary corps, which performs a similar service when any member of the hive colony dies, builds a tomb of wax about the body, sealing it as tightly as ever the tomb of a Pharaoh was closed

While studying the life of the been in the hive, Uncle Sam has not neglected their activities outside. By means of electric timing devices the departure and return of a bee are clicked on an automatic register. This delicate apparatus has shown that the honey-seeking flight of the bee is not so long as has been supposed-that the average time of absence from the hive is between five and seven minutes although the journey in search of honey may be as long as half a mile. The bee is a swift worker

Experiments are under way to determine the influence of ultra-violet light on the bee. Bees are practically colorblind, and the only possible explanation of their attraction to flowers of different colors seems to be that they are able to perceive rays beyond the humanly visible spectrum. This theory, advanced by Dr. F. K. Richtmyer of Cornell University and Dr. F. E. Lutz, entomologist of the American Museum of Natural History, seems to be well grounded in fact. If the work of the government exports confirms this belief, it well may lead to a special development of flowers rich in nectar and giving off strong ultraviolet rays; perhaps colorious to our eyes, but potently attractive to the been' manyfaced visual organs.

THESE important new facts about the attraction of flowers for been, were the result of ingenious scientific detective methods devised by Doctor Lutz. He found that he could trace and record every movement of a bee on its honeyquest by examining the pollen it gathered on its legs during visits to the flowers.

The short-cut invented by Doctor Lutz enables a scientist in his laboratory to gather facts in one day that the field worker could not collect in a year. Each time a bee visits a flower, it churns up the pollen grains in the blossom, and a number of these grains stick to its bury legs. With every visit to a new flower, more pollen is added, until it accumulates in a fluffy yellow ball on the rear legs of the insect, as shows on the cover of this insue. Returning home, the bee deposits this pollen in the cells of the hive as food for the young

Since each kind of flower has a different form of pollen grain. Doctor Lutz rightly deduced that the bee's collection of grains should indicate just where it has been. By brushing off the legs of a bee and examining the sweepings under a microscope, he can tell from the character of the grains just what flowers the bee has looted of honey on its last flight.

Similarly it is possible to keep a record of a bee's movements for months by the pollen deposits it leaves on the honey cells. Examination of the cells under the microscope reveals a complete "fingerprint" record of the honey-maker.

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Adventures in Home Ownership

(Continued from page 37)

"Now you're talking in my language,"

approved Jim heartily

"My suggestion is this," I explained. "Buy one of these houses and pay \$4900 cash. A bank will gladly lend the balance of \$3000 on a three-year first mortgage at 6 per cent, costing you \$180 a year. Taxes, insurance, and upkeep hardly will exceed \$280 more, or a total expenditure of \$460 m year.

"You're allowing nothing for amort-

ization," Jim interrupted.

"Not so fast; the plan is but balf unfolded," I replied. "My idea is for you to make no further principal payments. When your salary is raised, you want to sell this house and get a better one. The mortgage on the house will help to sell it. When the time comes, whoever buys it need put up only as much as you did His mortgage on the balance already is placed, and when the three years it has to run have expired, he can renew it easily on an amortization plan such as we have already talked of. Meanwhile you'll be living in your own home pretty cheaply "

"BOY, you've solved the problem?" on my back. "Let's see the houses. What do you say, Marion?"

"Well, I suppose we must," she agreed regretfully. "Of course you men know

best, but I do love this house."

She dabbed furtively at her face with a tiny handkerchief, but gave us a forlorn little smile as she trudged bravely out of the house.

"Hop right into the car," I hastened to say, opening the door. "We'll be there in

a jiffy."

Reaching the development, we came first to a pleasing little six-room semibungalow of stucco in the English-cottage half-timber style, priced \$7750 on our list

"This isn't the house I had in mind." I announced, "but lat's take a look just for the fun of it. The plan offers many step- and labor-saving features."

Entering the living-room through the front vestibule, I pointed out the English type recessed fireplace with brick hearth slightly raised, and the porch opening of at the side.

"IT CERTAINLY is quaint and charm-Ing." Marion commented, without enthusiasm. "A bedroom on the first floor, and a delightful winding stairway," she added, passing out into the back hall. "Oh, and a toilet room, too. How conventent!"

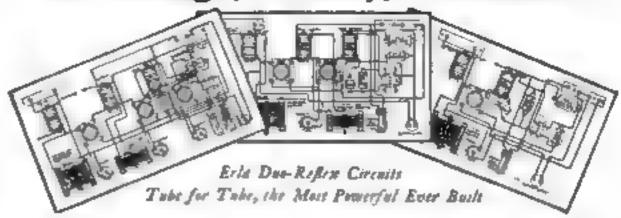
The unique thing about the house, I showed them, was a combined kitchen and dining-room, English-cottage style, a screen being set up across the arch between the two rooms when desired.

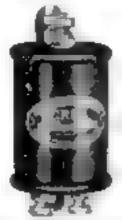
Marion laughed. "How foreign and funny," she said. "It saves steps, no doubt, and probably cost, but I don't like it, all the same, Let's look upstairs."

There we found two large bedrooms, somewhat irregular in shape, plenty of windows and closet space, a good bath-

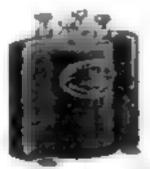
(Continued on page 138)

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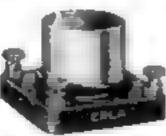




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"When I started here I was put at a desh and given critain couldn't things to do. But after a few months I beam to realise that I was nothing but a human machine and that I couldn't expect

ly advance that way.

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Adventures in Home Ownership

(Continued from page 137)

"It's a pleasant little place, but rather logged up and queer," was Jim's verdict.

jogged up and queer," was Jim's verdict.
"There are several nice features, but I think I'd prefer something more characteristically American," decided Manon.

Since that was the judgment of all of us, we lost no further time in going around the corner to the bouse I had in mind.

"Oh, what a lovely little box of a home!" cried Marion, as there came into view a white painted gambrel-roofed cottage of the Dutch colonial style, with attractive green shutters and a background of thrilty young shade trees, "I know that's the one. Am I right?"

I told ber it was.

"But I thought we'd have to take some ugly little shanty," she explained.

"THE great advantage of this Dutch colonial type," I said as we looked about the ample lot, "is that it offers so much for the money in room, real comfort, and convenience. It has six good rooms and bath, a full basement, an attic and 10 closets—count them yourself."

"One thing I mee," broke in Jim, "and

that is a porch."

"Yes," I agreed, "a permanent owner would want to add one outside the living-room. For a year or so, however, a lawn swing and chairs under three trees might take its place. The sleeping porch also is missing. Otherwise the floor plan is much like the house of Marion's choice."

"So it is" cried Marion, as we went inside and she began dancing about the rooms of the lower floor with reviving spirits. "Here's my big living-room and fireplace right over again. A pleasant dining-room and the cutest kitchen," she called from the rear of the bouse.

Proceeding more slowly, Jim and I appraised the hardwood floors and woodwork, the paint finish, electric fixtures, and wall-paper, and found them good. In the basement was an excellent heating

"Everything looks good to me," commented Jun. "Let's climb to the second floor."

THERE were three light and siry bedrooms of good size, with ample closets
and a well equipped bath. On careful
inspection, Jim and I decided that the
fixtures and plumbing measured up to
the besting plant.

"My mind's made up," said Jim after a final survey. "What do you say, ! Marion?"

"I think living here for a year or so, with the prospect of a better house soon, will be a delightful little adventure. I had no idea when I left that other house," she continued, "that we ever could find anything so much like it for so much less money. I almost expect when the time comes I shall feel sorry to leave it."

Jim fairly beamed.

Ram, in next month's laue, how Jim and Marion later built themselves a permanent home.



A cross-section cut through a receiver of the Stromberg-Carlson Radio Head Set reveals the layer wound and layer socialed coils.

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A Radio Tuning Unit

(Continued from page 74)

certain winding. To determine this figure, if you are using No. 20 wire, multiply the number of turns by the diameter of the tube in inches, and divide the product by 1146. For No. 22, the product of the number of turns and the diameter of the tube should be divided by 1834. For No. 24 It should be divided by 2904.

In the new combination unit, No. 22 d.s.c. wire was used. The tube on which the A and B coils were wound was four inches long, while that on which the C coil was wound was two inches long. The rotors were 814 inches in diameter with a half-inch winding space on each side of the shaft, making a total winding space of one inch, providing for 33 turns of the wire.

IN WINDING the coth, tape are easily made, as shown in detail 2 of Fig. 1, by holding the wire taut and twisting a loop in it with a bent piece of heavy wire

To anchor the ends of the windings, it is necessary only to drill two small holes. about one eighth inch apart. At the beginning of the winding, the end of the wire is passed from the outside to the inside of the tube, through one of these holes, then up to the outside through the other hole. in again through the first hole, and out again through the second hole. A loop to serve as a tap then is made in the end that has been brought out through the second hole. The other end of the winding can be anchored or fastened in the same way This type of fastening offers great strength,

To anchor the ends of the rotor winding, drill two holes on opposite sides of the rear rotor shaft. Twist two small loops in the form of a bow, as shown in detail 3. of Fig. 1, leaving a piece of wire about a half inch long to solder to the snds of the flexible rotor lead. Then wind half the rotor winding, inserting the end of the wire into the center of the rotor through a small hole drilled at the end of the winding. The other half is wound in exactly the same way and in the same direction, starting from the outside and winding toward the center of the rotor. The end of this half of the wire also is inserted into the center near the point where the end of the other half was spserted. The two ends are soldered together on the inside of the rotor, as shown in detail 4 of Fig. 1.

THE rotor leads should be made of flexible wire usually referred to as "pigtails." To make sure of good contacts, the insulation at the ends should be pushed back slightly, exposing the strands of the wire. A piece of small bare copper wire, from No. 24 to No. 26, then should he wound around the end, starting about three-gixteenths back of the end of the insulation. This serves the double purpose of building the insulation and wire together to prevent raveling of the insulation and also to serve as a positive connection between the lead and a terminal

The ends of the rotor leads may be connected with isolated acrews fastened hear the edge of the tube, as shown at detail 5, Fig. 1, so that connections from other parts of the circuit to the retor

(Continued on page 140)

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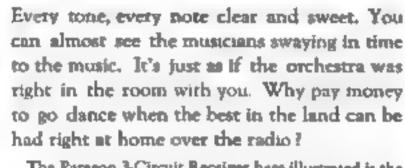
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A Radio Tuning Unit

(Continued from page 139)

winding can be made at these points, For best results the rotor should be of the type that has separate shafts for back and front. The rear shaft must be hollow so that the rotor leads may be taken to the outside connections.

The rotor bearing is made easily As shown in the photograph, a slot is filed in one edge of the stator tube to receive one end of the rotor shaft. Another similar slot is filed at the opposite end of the tube to receive the other end of the shaft. A hole then is drilled at each side of the alot. In these boles are inserted screws to serve as anchors for a wire that loops over the shalt of the rotor to hold the shaft in place.

ONE of these ocrews (as at 8, Fig. 1) is left rather long to serve as the stop for the projecting piece of wire (7), soldered on the shaft. This arrangement prevents the shaft from turning through more than one revolution and eliminates the tendency of the rotor leads to twist and break.

In selecting wire for winding the coils, slight differences in the type and size of wire will not affect the operation of the coil to any great extent. Usually, best resulta are obtained by using No. 22 a.e.e. or No. 22 d.s.d. wire.

In general, there should be about 40 turns in the primary winding, where a four-inch tube is used and where a .0005mfd. variable condenser is to be connected in parallel with the coil. When a .001mid. variable condenser is to be used in series with it, there should be 70 turns. From 40 to 50 turns in the secondary eno sidalitat, variable condenser across the coil, and from 30 to 40 turns on the tickler coll usually will give heat results.

If no condenser is used in the primary circuit, about 50 turns should be used in this winding

The latest practice in winding is to tap the coil at every 10 or, at the most, every five turns, and use a variable condenser of the Vernist type to provide the finer tuning. In this way only one switch is needed.

THE tension required to keep the rotor at whatever position it may be placed. is provided by the simple expedient of making the spacing washers, one of which in shown at 8, Fig 1, between the reter and the stator of such a threaness that the dutance between the outside faces of the washers is slightly greater than the inside diameter of the tube. This makes it necessary to spring the tube slightly to fit the rotor assembly into place. The elasticity of the tube is sufficient to provide a firm, even tension.

When the extra stator winding C is to be joined with the main stator tube, two small connecting links, as shown in detail 9 of Fig. 1, are used to connect the tubes.

Means for fastening the stator to the baseboard in mounting the unit is provided by the wire bent as shown at 10, Fig. 1

The variocoupler or double rotor tuning unit may be mounted on the panel by means of the bent wire supports shown at 11, 12, 13, and 14, Fig. 1.

Earth's Highest Citadel

(Continued from page 35)

sequent reception of too little oxygen. Its symptoms are extreme lassitude, weakness, mental fog, depressed spirits, and physical exhaustion after even the slightest efforts. Though the climber is constantly weak, tired, and sleepy, he cannot

sleep except brokenly

The terrific cold—between 20 degrees and 30 degrees below zero is the average temperature near the summit of Everest—sape the climber's waning strength. His hands and feet are likely to be frost-bitten. And yet, anomalous though it may seem, the rays of the sun are beating down on him with terrific ferocity. He is perpetually in danger of collapsing from sunstroke. From the great expanse of glistening anow the rays of the sun are reflected into the chimber's eyes. He wears smoked glasses, his cheeks and forehead are smoored with lampblack; yet there is always the danger of snow blindness.

NATURE, in a way, has supplied a compensation for the lack of oxygen in the atmosphere by causing the red corpuscies to multiply in the blood. These red corpuscies are the carriers of oxygen, and as they increase in number, of course, the oxygen supply of the body increases correspondingly. However, no man ever has been able to stay in extremely high altitudes sufficiently long to determine whether the multiplication of red corpuscies can progress to a stage that would make him immune to the debilitating effects of insufficient oxygen.

Physical suffering is the principal impediment to remaining near the peak. Besides this, conditions in the Himalayse are such that weather suitable for mountein climbing is not likely to last more than three or four days at a stretch.

TOWARD the end of the last climb, Bruce and Finch were progressing only 830 feet an hour. At that rate a little more than five hours would have been sufficient to enable them to negotiate the 1700 feet that stretched between their last stopping place and the top. Yet they were unable to make it. Physical man apparently had reached his simil.

But now Bruce and a dozen others are making another desperate attempt. Science has solved their difficulties as far as present-day knowledge can. The climb has been planned as carefully as a military campaign. Compressed oxygen in small, light tanks has been supplied to serve them in the thin air near the mountain top. Their food supply has been selected scientifically to furnish strength and energy when they have reached the limit of their courage and stamma.

Will they succeed?

They will if they can conquer Nature. Not Nature as represented by the towering majesty of Mount Everest, Titan of the earth's peaks, but Nature as exemplified in the indomitable spirit of man.

DID you read Raymond J. Brown's fuscinating story of atoms in the April Issue? If so, you won't want to miss his entertaining, understandable story of radium, the modern Philosopher's Stone—next month.



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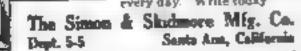
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How to Make Your Watch Keep Good Time

(Continued from page 36)

In 12 months the balance wheel of your watch revolves a distance of 4800 miles. The movement of a locomotive's wheels is slow and clumsy in comparison, and yet a locomotive is alled every few hours. All your watch sake is a tiny drop of oil not oftener than once a year; yet, if you are like thousands of watch users, you probably deny it even that much care.

If you want your watch to keep time, treat it gently and do nothing to disturb its calm. Probably the most destructive thing you can do to a watch is to drop it.

Habitually subjecting a watch to jolts and jars is another cause of injury. In wrist watches the casunities are especially Many young women who have brought me expensive wrist watches that weren't leeping time have been astonished when I have guessed their occupation as stenographers. My guess always has been based on the assumption that their watches had been thrown out of adjustment as a result of constant violent vibration, as the fingers of their owners have pounded a typewriter keyboard.

DAMPNESS rusts the delicate parts of a watch movement. Don't lay your watch down or hang it up near an open window-especially at night.

Guard your watch against dampness when you are at the seashore. And remove your wrist watch when bathing.

Dust, dirt, and sand can wreak destruction if they get into the movement of the watch. Never open the back of the case outdoors, or where the air is dusty.

If you break the crystal, or even crack it, have it replaced immediately, for the dust that reaches the dial through the crack may find its way into the movement.

Always keep your watch porket free from dust and lint.

If your watch is gaining or losing, make it keep time. You can do this just as well as a watchmaker, but of course you should use extreme care. In the back of the watch is a pointer, which must be moved toward "F" (Fast) if the watch is losing, and toward "B" (Slow) if the watch is gaining. Touch this pointer gently and move it as short a distance as you possib y can. After the regulator has been moved, wait several days before making further change. Then move it again. Repeat this process until your watch is running on the second.

REGULARITY in winding your watch is essential if it is to keep correct time. A watch should be wound every 24 hours, and at the same time each day.

You should have your watch cleaned and oiled at least once a year Remember that it ticks 157,000,000 times in 12 months, and that with every movement there is a friction strain on some part which can be relieved only by lubrication.

The modern watch is in reality a box of wonders. It is the one marvel of science

that every man uses.

Your watch, in short, is your most important possession, your most faithful friend. Counder its marvels, and you will never again treat it casually.

7FFH-S9W-U1DW

Here Are Correct Answers to Questions on Page 71

- The coldness and dryness of the air cools the skin. This increases the circulation of blood. The better circulation carries more oxygen to the brain and other organs and makes us feel more active.
- 2. In samples of rock that explorers have brought back from the polar regions, geologists have found fossils of plants that grow only in warm countries.
- The air contains a small amount of sulphur gases, derived, usually, from the sulphur contained as an impurity in coal and other fuels. Silver takes up the sulphur gases and forms a black compound called "sulphid of silver."
- 4. Yes. The waves that are shorter than about 70,000 to the inch cannot be seen by our eyes, though they are otherwise just the same as light. These are called the "rays of ultraviolet light."
- 5. Among other changes the heart beats faster and the sizes of the different blood vessels are altered. The arteries leading to the digestive organs become smaller, while those leading to the beart, the lungs, the brain, and the other nerve cen-Thus the blood in ters become larger. taken away from the organs that are not going to need it so urgently and is sent where it is needed more. It becomes well charged with oxygen, which will be needed in the muscles in case you have to fight or to run away, and plenty of the well-oxygenated blood is sent to the brain to aid in controlling these muscles.
- 6. The layer of air next the ground gets heated, usually because the sun overbeats the ground and this heats the air next to it. This hot layer of air bends back the rays of light just as though it were a mirror. So it reflects the light of the sky just as a water surface would.
- 7. It is called the "pineal gland." It has somewhat the same nerve connections and structure as an eye and it corresponds to an organ found in many fossil lizards, which may have been an actual eye on top of the head.
- White reflects the heat rays from the aun. Black obsorbs them.
- Weight is merely the attraction of gravity and it exists between any two pieces of matter. So scientists first determine the amount of the attraction be-tween a small piece of matter, say a tiny ball of pith, and a huge mass of lead. Then they determine the attraction of the earth for the small ball of pith. This will be a great many times as much as the attraction of the mass of lead for the pith ball. The earth is just that many times heavier than the mass of lead.
- 10. It is a toxin produced by the germ that causes botulism, a form of food
- 11. It is a difference in how far the atoms or molecules inside the substance are away from each other. If they are very close together, the substance is solid. they are a little farther apart, so that they can move around freely, the substance is a liquid. If they are so far apart that they have no attraction for each other at ali, then the substance is a gas.
- 12. No. Whenever these are studied scientifically, it is found that "hunches" or reasonless predictions are no more accurate than mere baseless guesses are. There is no evidence that man is able to foresee the future in any way except in so far as he can do so by his reason.

For expensive, delicate parts what panel will you use?

Celoron Radio Panels were

the first to be cut in standard

sizes and wrapped to individ-ual packages. They come in the following standard sizes, finished in black, mahogany

Special sizes cut to order

from sheet stock.

or calk

THE picture shows the front of a Super Heterodyne hook-up. This set has a normal range of 3,000 miles. When a radio fan builds this set he must use the best radio parts he can buy. And he needs a panel that will help those parts operate most efficiently,

A weak battery, a burned-out tube any defective part-merely reduces the range of a set instantly. A cheap radio panel can hinder the effectiveness of the best in-

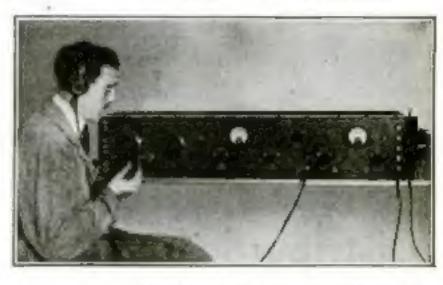
alruments made.

Radio fans all over the country construct their sets around Celoron Standard Radio Panels. One of them. Mr. Phil Davies, of Grand Rapids, Michigan, writes about his Celoron panel:

> "I bought a Celoron Panel, first, because of the low loss of high frequency currents and its high dielectric ca-

pacity; second, because of its strength and durability; third, because of its beautiful fixish; fourth, because of its convenient size.

Radio set manufacturers who use Celoron panels in their cabinets help fans get greater volume and clearer Manufacturers of radio parts who mount their instruments on Celoron bases give insulation those parts need. In Celoron they have a bakelite product that is one of the best insulating materials known. Its dieletric strength has been proved time and again. The U. S. Signal Corps and U. S. Navy approve it heartily.



Radio manufacturers can buy Celoron in sheets, tubes, rods, and special forms. Leading radio part makers have already found that Celoron is an ideal material to use for cabinets,

> switch bases, and other radio and wireless

equipment.

Radio fans who buy completed sets containing Celoron Standard Radio Panels and instruments insulated with Celoron can be sure of getting the insulation their nets need. Write to us for complete information regarding the use of Celoron in

the manufacture of sets and individu-

al radio parts.

Write for our free booklet, "Getting the Right Hook-up with Celoron." It contains diagrams, list of broadcasting stations, and valuable radio information for the set-builder.

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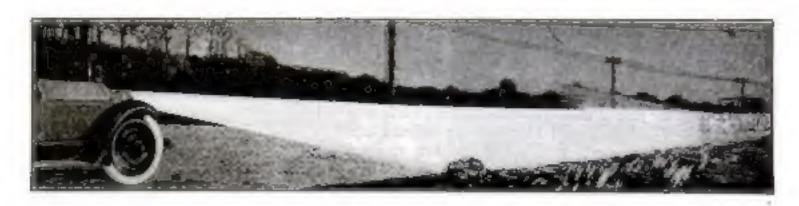
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Enclosed # mailed postag		for offer	us marked at	hove. These to be
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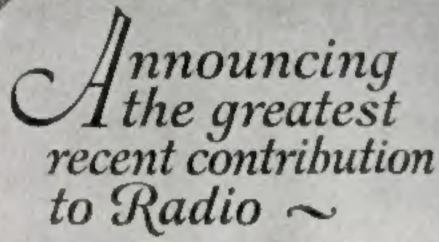
One set of Detroit Safety Headlight Devices in a neighborhood makes everyone want them. It's the best kind of advertising for our representatives. Therefore, for a short time we will sell two sets for the price of one (\$2.00) or one set at wholesale price of \$1.00, postage paid. Buy two sets, sell one easily at \$2.00—yours will be free. This offer is open to everyone to advertise the devices. When territory Representatives are appointed offer ceases—so act now. Easily installed by anyone. Get literature—clip FREE coupon, fill in, pin \$1 or \$2 bills to coupon—act quickly NOW.

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Women, everywhere are going to have a wonderful change this Summer, Instead of being slaves to hot, mussy kitchen stoves they will have all conveniences of city gas. Just a little heat quickly when needed to cook a meal—then—"presto"
—the fire is turned off before it has had time to heat up the kitchen. And not only do they have this wonderful convenience, but many are actually saving in fuel bills besides. New, any range or cook stove-no matter what type or how old-can be turned into a real gas stove in a few minutes-by the installation of the famous Oliver Oil-Gas Burner, No. holes to drill, no changes whatever to your stove. Can be installed by anyone,

Wonderful Baking and Cooking

This means that you can have the use of your good, dependable range right through the Summer—yet you do away with with the muss and drudgery of building fires—the building fires—the building fires—the building these few you have a fire only during these few

minutes. Turn a valve and you have any degree of heat needed—reverse the valve and the fire is instantly out. Women using Olivers tell of taking prizes with their baking—and how they bake bread, biscuits, light fluffy cakes and pies, done just right in an oven that is quickly regulated to any even temperature. No more burned or overcooked food.

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This wonderful convenience is called the Oliver Cild Can Bureau, because it combines missues particles of oil with a large quantity of air to form an income, clean, blue white flame. No wicks, no smoke, no odor, Absolutely safe, Makes extra oil street, that take up space in your kitchen, amore are Numerous advantages over coal and woodle burner. Pall, Waster and Spring hearing, its coalete for ranges, moves and furnaces. Over 200,000 already in use.

Fits All Stoves-Get Free Book

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